

**FINAL HYDRAULICS REPORT
RIVER STYX BRIDGE REPLACEMENTS
APALACHICOLA NATIONAL FOREST
LIBERTY COUNTY, FLORIDA**



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FINAL HYDRAULICS REPORT RIVER STYX BRIDGE REPLACEMENT APALACHICOLA NATIONAL FOREST LIBERTY COUNTY, FLORIDA

INTRODUCTION

This report presents the results of the hydrologic and final hydraulic analyses performed for two bridges located on Forest Development Road (FDR) 115, Apalachicola National Forest, and Liberty County, Florida. The analyses were performed to identify bridge replacement alternatives.

BACKGROUND

The existing two bridges are located at mileposts 2.3 (bridge #1) and 2.5 (bridge #2) approximately 9 miles northwest of Sumatra, Florida. A map showing the location is included in **Figure 1**. Photos of each bridge are included in Figure 2 and 3.

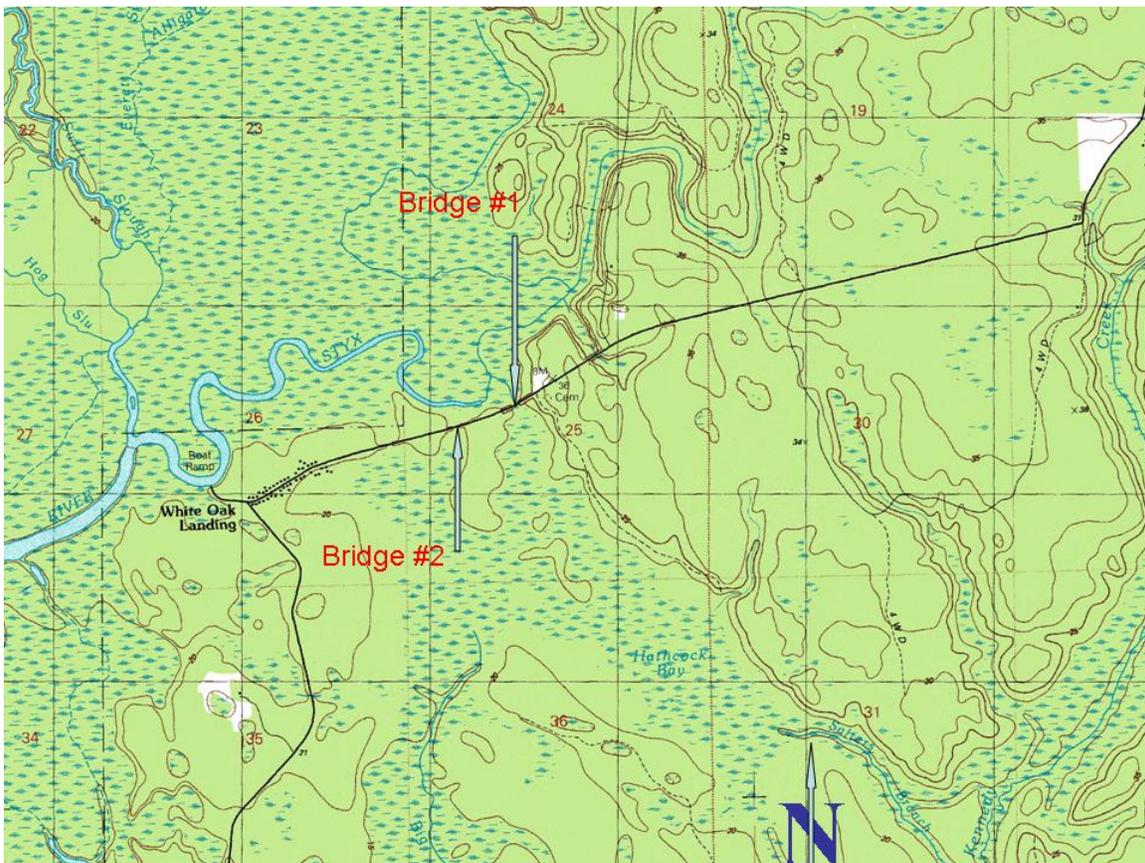


Figure 1: Location map showing two existing bridges.



Figure 2: Bridge #1



Figure 3: Bridge #2

Both bridges are 70 year old timber structures, each having a 46 ft span, supported by timber pile walls, timber abutment walls and wingwalls. The integrity of both structures

has deteriorated to the point that neither structure can safely support design loads. Given the age of these structures, the Forest Service has designated them as having historic value and desires to construct two new structures while leaving both structures in place. The new drainage structures will be located immediately north of the existing bridges on a realignment segment of road.

These bridges are not located on identifiable drainageways, but rather serve to pass overbank flood flows from the River Styx and the Apalachicola River. The topography is depressed at the bridge locations, but there is not a well-defined channel upstream or downstream of either bridge. The FDR 115 road profile in the vicinity of the bridges is close to the adjacent ground elevations, but the bridge decks are several feet above the road profile. During large storm events, flows pass under the bridges and overtop the roadway. According to the Forest Service road maintenance staff, the roadway is inundated for extended periods annually.

Both bridges are located along the eastern fringe of the Apalachicola River FEMA floodplain. A copy of the FEMA Flood Insurance Rate Map (FIRM) showing the locations of the bridges relative to the floodplain delineation is included in Appendix A. Based on the FEMA floodplain Base Floodplain Elevations (BFEs), the roadway and bridges are inundated by several feet of water during a 100-year event. The bridge deck elevations are 24.82 feet and 24.66 feet, while the of FEMA 100-year BFE is approximately 28.0 feet.

The purpose of this study is to support the bridge replacement alternatives and final design of a selected alternative. Since the local drainages determined at both crossings are very minor, the hydraulic analysis focuses solely on the Apalachicola River overbank flows. Given that the project is located within a FEMA 100-year floodplain with no designated floodway, it is our responsibility to demonstrate that the proposed improvements will not impact the FEMA floodplain. Although significant modifications (road grade changes) may be permitted within the flood fringe, this would require extensive revisions to the Apalachicola FEMA floodplain model, detailed analysis and delineation of the floodway, and FEMA approval, which will add significant delays to the project. To avoid these delays, we recommend that hydraulic impacts be avoided by maintaining the existing road profile and hydraulic conditions in the vicinity of the bridges.

HYDROLOGIC ANALYSIS

Since the bridges are located within the FEMA floodplain, both local drainage as well as overbank flood flows from the Apalachicola must be evaluated. As note above, the local drainage is negligible, but the results of the analysis are presented in the following.

Local Drainage

Design peak discharges for local drainages that are tributary to the two bridge crossings were estimated using the methods outlined in “Magnitude and

Frequency of Floods in Florida January 2004”. The drainage areas were delineated from the USGS Kennedy Creek, Florida quadrangle map, using the Watershed Modeling System, (WMS) version 8.0 to delineate the drainage basin for the two existing bridges. The basin delineations are shown in Appendix B. The peak runoff for each drainage was estimated using the Rational Equation.

Rational Equation:

The equation is expressed as:

$$Q = CIA$$

Where: Q = Peak Flow Rates (cfs)

C = Runoff Coefficient

I = Rainfall Intensity (in/hr). The rainfall intensity is determined from the appropriate Intensity-Duration-Frequency (IDF) curve based on the time of concentration and the storm frequency.

A = Area (acres)

C = 0.45 for light underbrush area

IDF curve was developed by “Drainage Design for the Roadway Designer”, May 31, 2006.

The estimated peak discharges for each watershed are listed in Table 1:

Table 1: Peak Discharges Summary

Bridge Number	Drainage Area (acres)	Q ₅₀ (cfs)	Q ₁₀₀ (cfs)
#1 MP 2.5	9.81	35	37
#2 MP 2.3	4.89	17	19

Apalachicola River Drainage

The peak discharges shown in Table 2 are estimated in the FEMA Flood Insurance Study (FIS) (July 16, 1991):

Table 2: Summary of Apalachicola River flows (FEMA 1991)

Flooding Source	Drainage Area (mi ²)	Q ₂ (cfs)	Q ₁₀ (cfs)	Q ₅₀ (cfs)	Q ₁₀₀ (cfs)	Q ₅₀₀ (cfs)
Apalachicola River	19,200	105,000	169,000	230,000	257,000	322,000
River Styx	2.2		250	400	500	650

HYDRAULIC ANALYSIS

The hydraulic analysis was initiated by obtaining the current effective FEMA hydraulic model for the Apalachicola River. A portion of the FEMA model, representing the river reaches immediately up and downstream of the FDR 115 bridges, was extracted for use in this project to evaluate bridge replacement alternatives and associated hydraulic impacts. Since the FEMA model is a fairly coarse, representation of the entire Apalachicola River, several cross sections were added to represent the profile of FDR 115 and the existing bridges. These cross sections were generated by interpolating between adjacent FEMA cross sections and supplementing the cross section data collected by EFLHD with recent survey data in the vicinity of the bridges.

For most major waterways, both the 100-year floodplain and floodway are typically defined and regulated by FEMA. However, for the Apalachicola, only the floodplain has been identified at this time. The floodway delineates the maximum limit that the floodplain can be encroached upon without compromising the conveyance of flood flows. Development (fill and other obstructions) is usually permitted in the margins between the floodway and floodplain limits (flood fringe) and is allowed to cause up to a 1.0 ft rise in the river during a 100-year event. However, since a floodway has not been defined by FEMA, our options are to either evaluate and delineate the floodway or prove that our proposed improvements will not have adverse hydraulic impacts. Since the floodway delineation would require extensive hydraulic analysis and review by FEMA, causing significant delays and expense to the project, the hydraulics team proceeded with the assumption that it is in the best interest of the project to identify alternatives that will create no adverse hydraulic impacts (i.e., no rise in upstream water surface).

To evaluate the impacts proposed project improvements relative to the FEMA hydraulic model and it's geometric representation of the river and its floodplain, the following modeling steps were necessary. All hydraulic modeling was conducted using the HEC-RAS Model, version 3.13.

- 1) Duplicate Effective Model. This model duplicates the information presented in the current effective FIS and is based on information obtained from FEMA. This model essentially demonstrates that we are obtaining the same model results as summarized in the FIS. However, the original results are difficult to replicate exactly since the FEMA model is based in the outdated HEC-2 model, which has been replaced by HEC-RAS.
- 2) Corrected Effective Model. The corrected effective model incorporates any model corrections and additional cross sections that are needed to represent locations of project features and proposed improvements.
- 3) Existing Condition Model. Once a satisfactory Corrected Effective model is developed, an existing conditions model is developed to reflect new topography and site conditions. This model serves as the baseline for evaluation of project improvement impacts.
- 4) Proposed Condition Model. A new proposed condition model is

developed for each improvement alternative. Results are compared to the existing conditions model to assess hydraulic impacts. This model is the source of data bridge design and scour calculations summarized in this report.

Since the current bridges and roadway profile are not represented in the FEMA hydraulic model, additional cross sections were added in HEC-RAS by interpolating between the existing adjacent cross sections. Cross sections were interpolated such that sections were located on either side of the road (upstream and downstream of each bridge). The top of road and bridge deck profile was then added in the HEC-RAS deck/roadway editor to represent the overtopping profile. A map showing the FEMA HEC-2 cross sections that were used to develop the HEC-RAS model is included in Appendix A.

The study limits for this project were selected to ensure that the hydraulic effects of the proposed bridges could be adequately evaluated. Data from the existing FIRM were digitized (river alignment and cross sections locations), geo-referenced to current aerial photographs and new topographic mapping, and subsequently exported to the HEC-RAS model. Except for the new topographic data in the vicinity of the bridges, the HEC-RAS model is based on cross section data supplied by FEMA.

Current topographic mapping and field survey data were used to develop the bridge layouts and supplement the FEMA cross section data in the vicinity of the bridges. The model was used to determine hydraulic design parameters required for the bridge structure selection and design. In addition, scour and erosion prediction calculations were performed to determine the need for bank protection.

FHWA criteria for bridges in FEMA floodplains state that two feet of freeboard must be provided below the bridge low chord elevation for the 50-year design flow, and one foot of freeboard for the 100-year flow (Section 7.4.3.4 of the FLH Project Development and Design Manual (January 2006)). Similarly, Florida DOT drainage criterion requires two foot of freeboard for the 100-year storm. However, since these bridges are secondary structures, not located on the main waterway, the free board criteria do not apply. The effect of raising the bridges and adjacent road profiles to meet these criteria levels would block a significant portion of the overbank flow causing significant hydraulic impacts. Furthermore, since much of the adjoining road is inundated during annual high flow events, raising isolated segments of the roadway is not cost effective.

Methodology:

Water surface profiles were computed using the U. S. Army Corp of Engineers “HEC-RAS River Analysis System” (Version 3.13) computer program. HEC-RAS computations for calculating water surface profiles for gradually varied flow are based on the solution of the one-dimensional energy equation. All boundary condition flow regimes and energy loss coefficients were consistent with the FIS. Areas of ineffective flow were modified as needed to reflect actual conditions. Coefficients of expansion and

contraction of the existing and new bridges were adjusted based on standard practice. The new bridges are proposed upstream of the existing bridges due to horizontal and vertical roadway alignment considerations.

The computation of scour at bridges within HEC-RAS is based upon the methods outlined in Hydraulic Engineering Circular No. 18 "Evaluating Scour at Bridges". Publication No. FHWA NHI 01-001 May 2001.

Manning's Values:

The Manning "n" values were determined from the existing FIS. The values ranged from 0.03 to 0.135. These values appeared to be relatively low in some locations especially where thick stands of trees had matured in the stream channel. For the final HEC-RAS model, the channel values were increased slightly from 0.03 to 0.04 in the vicinity of the new bridge.

For the downstream boundary condition, known water surface elevations from the existing FIS were used (cross section # 12). FIS model results used for the boundary conditions are included in Appendix A. Model flows included the 10-yr, 50-year, 100-yr, and the 500-yr, based on the flow data presented in the FIS.

Summary of Hydraulic Analysis:

Three alternatives were taken into consideration. Selection of a recommended alternative will be based on factors such as available space, cost to construction, ease of maintenance, and ability to eliminate deep foundations. The three alternative crossing structures that were considered at each bridge replacement site include: 1) 46' Con/Span, 2) Double 16' x 8' concrete box culverts, and 3) 48" reinforced concrete pipe (RCP). The results of the HEC-RAS modeling for all three scenarios evaluated are included in Table 3.

The duplicate effective model compares reasonably well with the water surface elevations published in the FEMA. This demonstrates that the project base line hydraulic model compares closely with the FEMA hydraulic model. The minor differences are due to the updates/improvements from the HEC-2 model used in the original FEMA analysis to the current HEC-RAS model.

For the existing conditions scenario, the water surface elevation upstream of the bridge is increased slightly due to the addition of new cross sections that reflects existing road profile and bridges that were not included in the FEMA model.

The result of the alternative analysis demonstrates that the upstream water surface elevations are not dependent on the type of structure during flood flows. The capacity of the structures is insignificant when compared to the total flood flow in the Apalachicola River.

The results of the HEC-RAS model for all the scenarios evaluated is include in Table 3.

Table 3: Summary of 100-Year Water Surface Elevations (ft-NGVD 29)

Cross Section	FIS WSEL	HEC-2 Duplicate Effective Model	Existing Conditions RAS model	Proposed Conditions RAS model
20	30.60	30.86	31.07	31.08
19	28.58	28.64	28.92	29.08
18.779				
18	26.57	26.68	27.23	27.23
17	25.68	25.83	26.32	26.32
16	24.63	24.77	25.22	25.22
15	23.29	23.28	23.65	23.65
14	22.81	22.82	23.18	23.18
13	21.43	21.43	21.63	21.63
12	20.14	20.14	20.14	20.14

Floodplain Impacts:

FDR 115 is located between Cross Sections 18 and 19 on the Apalachicola River. The results of hydraulic analysis indicate that the current 46 ft wide bridge openings are larger than what is needed to convey local drainage as well as flood flows from the Apalachicola River. In fact, modeling of various alternatives showed that replacing the existing bridges with triple 12’x 8’ box culverts would have no impact on the FEMA 100-year water surface elevation.

Recommended alternative #2 based on discussion with project team and NFS staff.

Scour Evaluations:

The proposed CON/SPAN and the roadway include a current 100-year floodplain and velocity less than 1.00 ft/s. Therefore, no scour evaluation is required for this project.

Proposed Bridge Design Requirements

1. Design Constraints

Design constraints include the need to match vertical grades at FR 115, the horizontal alignment mandated by the needs of the connector roadway, the environmental permit issue mandating that the bridge span the jurisdictional private lands areas, and the existing FEMA regulatory floodplain and floodway.

2. New Box Culverts Design Parameters

The proposed new triple 12' x 8' concrete box at each crossing will be 16-foot long precast sections with concrete headwalls and wingwalls. The new culverts shall be embedded into the ground approximately one foot to provide natural material with bottom of this structure.

Table 4: Summary of Design Recommendation

Structure Type	BOX CULVERTS
Culvert Span	12 feet
Skew	0 degree
Mean 100-year Channel Velocity	0.16 ft/s
Q ₁₀₀ (FEMA)	257,000.00 cfs
100-year WSEL	29.88

SUMMARY AND RECOMMENDATIONS

The proposed replacement of the River Styx Bridges is not requires realignment of the existing roadway. The drainage recommendations within this report and as showned in the design plans will improvement drainage conditions along the roadway. The design of these proposed improvements has been refined during the final design phase and is reflected in the final plans and hydraulics report. The bridge waterway is designed in compliance with the provision of 23 CFR 650 Subpart A, Bridges, Structures, and Hydraulics. The 100-year recurrence interval discharge water surfaces are given in Table 3.

The following list below is a summary of the hydraulic analysis and recommendations for the River Styx Bridges replacement.

Based on the results of the hydraulic analysis and above discussion, the project team reviewed various alternatives and identified the following three options:

- 1) Alternative #1 – Install a 42' CON/SPAN precast modular concrete bridge just upstream of each existing bridge location. Maintain the existing road profile of the existing bridges. The ground elevations through the culvert would be excavated to elevations similar to the existing bridge crossings.
- 2) Alternative #2 – Install multiple barrel box culverts at each bridge location to replace the existing bridge opening of 46'. It is recommended that a triple 12'x8' Reinforced Concrete Box (RBC) to replace bridge #1 and a triple 12'x8' (RCB) to replace bridge #2. Headwalls and wingwalls are required. The culverts will have depths and velocities comparable to the natural stream embedment of two feet to provide a natural invert. Precast box culverts are available in spans up to 26'. Maintain the existing road profile along an alignment as the same location of the

existing bridges.

- 3) Alternative #3 – Install a single concrete culvert at each bridge site. Use a 4' Corrugated Metal Pipe (CMP) to replace bridge #1 and a 48" (CMP) to replace bridge #2. Reduce the road profile by flattening the vertical curves to create a more uniform profile. The lower roadway profile will improve sight distance.

Assuming that the existing bridges will remain in place for historic preservation, Alternative #1 and #2 will provide openings that are more consistent with the existing bridge which will be more aesthetically pleasing. Alternative #1 would require a significant foundation, while Alternative #2 would not. Alternative #3 is certainly feasible from a hydraulic standpoint, but may not 'fit-in' with the aesthetics of the existing structure, consequently Alternative #2 is recommended.

OUTLET PROTECTION:

The proposed box culverts and the roadway include a current 100-year floodplain and velocity less than 1.21 ft/s. Therefore, no riprap protection is required for this project.

REFERENCES

1. Watershed Modeling System, Version 8.00, Brigham Young University, Utah.
2. Hydrologic Engineering Center River Analysis System, HEC-RAS, Version 3.1.3, U.S. Army Corps of Engineers (USACE), May 2005.
3. Evaluating Scour at Bridges, HEC-18, Fourth Edition, Publication No. FHWA NHI 01-001 May 2001.
4. Federal Highway Administration, Federal Lands Highway Project Development and Design Manual, FHWA-DF-00-003, June 1996.
5. Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (FHWA-IP-85-15).
6. Roughness Characteristic of Natural Channels, United States Geological Survey Water Supply Paper 1849, Washington D.C., 1967.
7. HYDRAIN Integrated Drainage Design Computer System, Version 6.0, U. S. Department of Transportation, Federal Highway Administration.
8. State of Florida Department of Transportation, Drainage Handbook Hydrology, January 2004.
9. State of Florida Department of Transportation, Drainage Manual, January 2004.
10. Flood Insurance Study for Liberty County, Florida (unincorporated Areas), July 16, 1991.

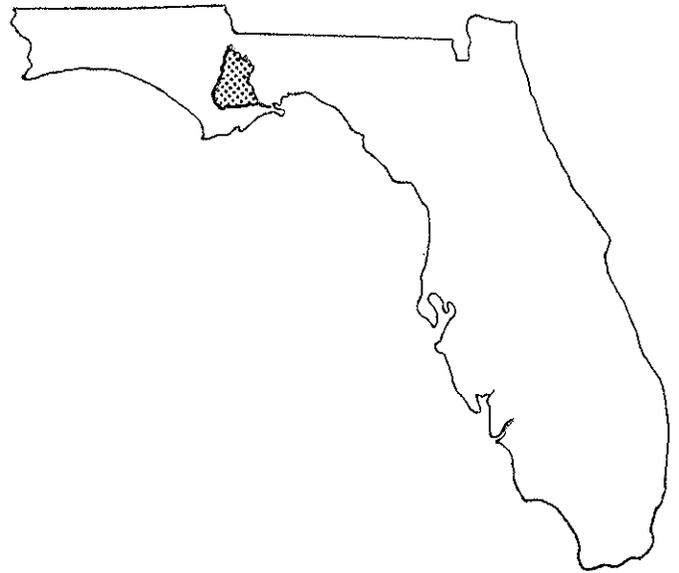
FL PFH 12-1(1) River Styx Bridge Replacement

APPENDIX A – FEMA DATA HEC-2

FLOOD INSURANCE STUDY



LIBERTY COUNTY,
FLORIDA
UNINCORPORATED AREAS



JULY 16, 1991



Federal Emergency Management Agency

COMMUNITY NUMBER - 120148



NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

LIBERTY COUNTY,
FLORIDA
(UNINCORPORATED AREAS)

PANEL 225 OF 350

COMMUNITY-PANEL NUMBER:
120148 0225 B
EFFECTIVE DATE:
JULY 16, 1991

Federal Emergency Management Agency



This is an official copy of a portion of the above referenced flood map. It is not to be used for any other purpose. This map does not reflect changes or amendments which may have been made since the date of the original map. For the latest product information about National Flood Insurance Program flood maps, check the FEMA Flood Map Store at www.fema.gov.

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
APALACHICOLA RIVER					
at Sumatra stream gage	19,200	169,000	230,000	257,000	322,000
at Wewahichka stream gage	17,800	163,000	222,000	250,000	314,000
at Blountstown stream gage	17,600	160,000	220,000	248,000	313,000
TELOGIA CREEK					
about 0.57 mile upstream of mouth	246.0	8,800	16,000	19,700	30,500
about 2,200 feet upstream of confluence of Yellow Creek	224.0	8,500	15,200	18,700	28,900
about 400 feet downstream of confluence of Barbeque Branch	214.0	8,300	14,800	18,200	28,000
about 1,000 feet downstream of confluence of Driver Branch	203.0	8,000	14,300	17,600	27,100
about 2,100 feet downstream of State Road 65	179.0	7,300	12,900	15,800	24,100
CAMP BRANCH					
at mouth	3.3	400	700	900	1,250
just upstream of State Road 379	2.7	350	600	750	1,100
about 2,100 feet upstream of State Road 379	2.3	300	550	650	950
just upstream of State Road 379A	1.9	200	400	500	650
about 0.8 mile upstream of State Road 379A	1.3	100	250	300	350

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (SQ MILES)</u>	<u>PEAK DISCHARGE (CFS)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
BLACK CREEK (cont.) about 2 miles upstream of confluence of Hog Branch	15.9	950	1,600	1,900	2,650

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

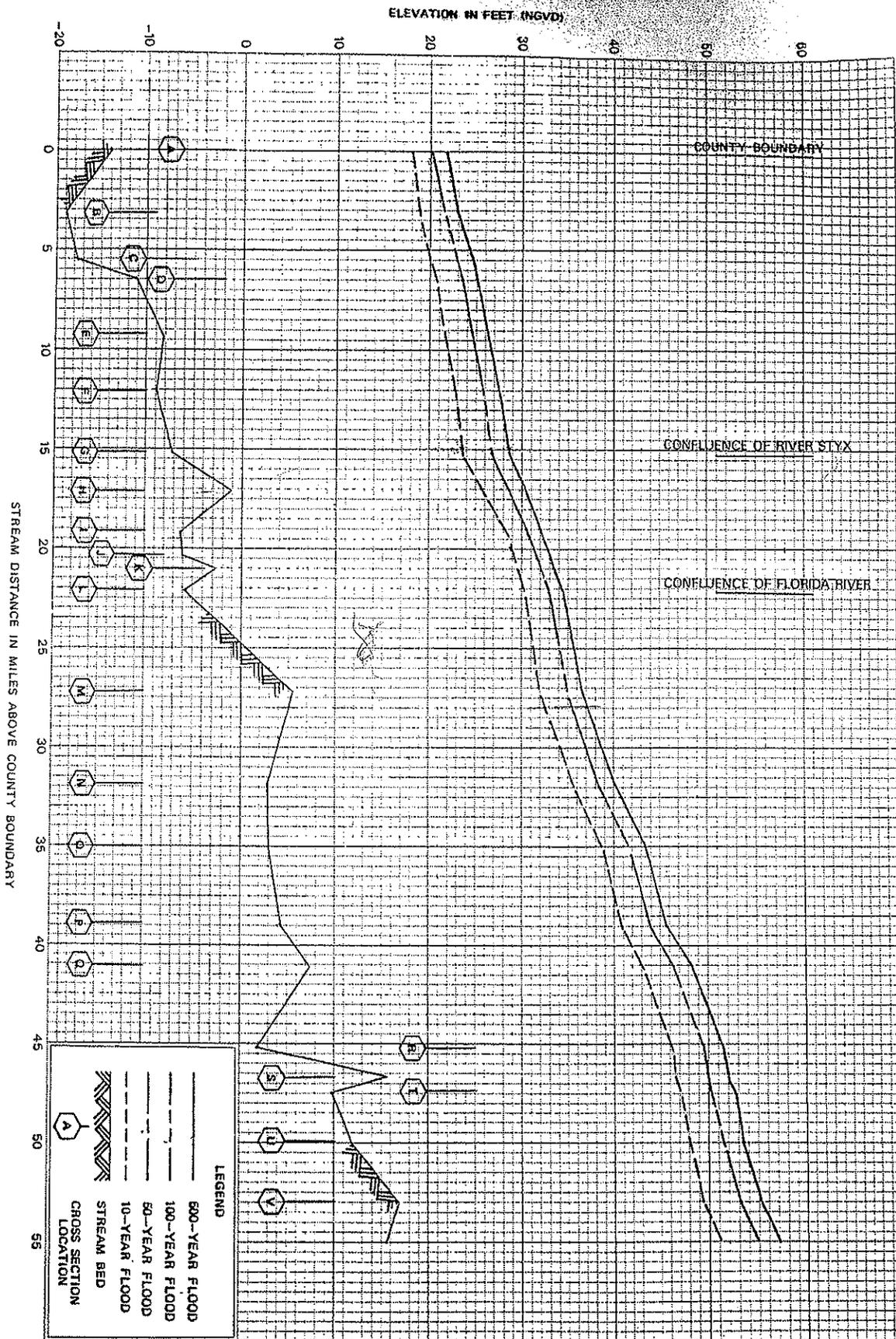
Cross sections were obtained from field surveys for Telogia Creek, Camp Branch, Big Gully Creek, South Creek, the River Styx, and Black Creek (Reference 8). Cross-section information for the Apalachicola River were obtained from the Mobile District, COE (Reference 9). In some cases, topographic maps (Reference 7) were used to extend surveyed cross sections for floodplain geometry. All bridges and culverts were field surveyed to obtain elevation and structural geometry data.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Roughness coefficients (Manning's "n") used in the hydraulic computations were determined on the basis of field inspections and engineering judgement (References 10-12).

<u>Stream</u>	<u>Roughness Values</u>	
	<u>Channel</u>	<u>Overbank</u>
Apalachicola River	0.03	0.135
Telogia River	0.05	0.15
Camp Branch	0.05-0.08	0.07-0.18
Big Gully Creek	0.05-0.08	0.15
South Creek	0.05-0.08	0.15
River Styx	0.05-0.06	0.15
Black Creek	0.05-0.07	0.15

Water-surface elevations were computed using the HEC-2 computer program (Reference 13). The slope-area method was used to compute the starting water-surface elevation for the Apalachicola River, Telogia Creek, Camp Branch, Big Gully Creek, South Creek, and Black Creek. The starting water-surface elevation, using



DIP

FEDERAL EMERGENCY MANAGEMENT AGENCY

LIBERTY COUNTY, FL
(UNINCORPORATED AREAS)

FLOOD PROFILES

APALACHICOLA RIVER

 HEC2 RELEASE DATED NOV 76 UPDATED MAY 1984
 ERROR CORR - 01,02,03,04,05,06
 MODIFICATION - 50,51,52,53,54,55,56

71 FIS - LIBERTY CO., FEMA
 72 100 YEAR FLOOD ELEVATION
 73 AREA AC-TOTAL 3.1748 311

71	NO-HECK	NO	MINV	DIR	STRT	METRIC	HWINS	Q	WSEL	FQ
	2.	2.	0.	0.	.222222	.00	.0	0.	20.140	.000
72	MAGP	PLST	PREVS	XSECV	XSECH	FX	ALLC	IBW	CHWIN	ITRACE
	-1.222	.000	-1.000	.000	.000	.000	.000	.000	.000	.000
73	VARIABLE CODES FOR SUMMARY PRINTOUT									
	150.222	.000	.000	.000	.000	.000	.000	.000	.000	.000

AC	1.135	1.135	.000	.100	.300	.000	.000	.000	.000	.000
27	1.222	257222.000	.000	.000	.000	.000	.000	.000	.000	.000
31	12.222	33.000	20183.000	20650.000	.000	.000	.000	.000	.000	.000
32	25.222	-13622.000	15.200	-13500.000	12.000	-7900.000	10.000	7000.000	9.000	5200.000
33	0.222	13022.000	7.200	16000.000	6.000	17000.000	8.400	20000.000	8.400	29000.102
34	5.222	20050.000	7.400	20183.000	-7.600	20130.000	-11.600	20140.000	-11.600	20150.000
35	-13.422	20160.000	-13.600	20170.000	-13.100	20210.000	-8.200	20190.000	-3.900	20520.000
36	-6.622	20020.000	-6.100	20620.000	-4.200	20630.000	7.100	20645.000	5.000	20650.000
37	1.222	20710.000	5.100	20755.000	5.100	20756.000	6.000	21356.000	10.000	22256.000
38	12.222	20635.000	20.000	27835.000	25.000	31000.000	.000	.000	.000	.000
39	.222	37.222	20114.000	20550.000	12000.000	15000.000	16400.000	.000	.000	.000
40	2.222	-3222.000	15.222	3222.000	12.000	4000.000	10.000	5500.000	9.000	9000.000
41	1.222	4222.000	10.000	9500.000	10.100	20000.000	10.100	20000.102	10.200	20074.000
42	.222	12224.000	10.500	20124.000	3.400	20114.000	-7.600	20124.000	-12.100	20134.000
43	-1.222	20154.000	-15.222	20164.000	-15.400	20174.000	-19.100	20184.000	-13.200	20192.000
44	.222	20294.000	-5.100	20294.000	-5.100	20404.000	-3.500	20424.000	-1.300	20474.000
45	.222	20454.000	1.400	20514.000	8.900	20524.000	9.100	20534.000	10.900	20550.000
46	12.222	20634.000	12.000	20634.000	10.000	20634.000	16.000	20634.000	20.000	20634.000
47	.222	30000.000	32.000	40000.000	.000	.000	.000	.000	.000	.000
48	.222	33.000	20110.000	20450.000	10500.000	10700.000	11900.000	.000	.000	.000
49	12.222	4742.000	22.000	6000.000	13.000	2200.000	9.000	12500.000	10.000	16700.000
50	.222	5022.000	11.000	19000.000	12.200	20000.000	12.200	20000.102	12.000	20000.000
51	1.222	20110.000	1.700	20140.000	-2.600	20150.000	-7.600	20170.000	-9.100	20180.000
52	-1.422	20150.000	-16.100	20234.000	-15.700	20250.000	-17.500	20370.000	-11.600	20410.000
53	-1.200	20420.000	-4.200	20472.000	.500	20440.000	3.000	20450.000	11.200	20460.000
54	1.200	20470.000	12.000	20505.000	10.000	20570.000	10.000	20770.000	10.900	20770.000
55	1.200	20570.000	20.000	35000.000	30.000	35400.000	.000	.000	.000	.000

X1	11.820	32.890	20110.000	20466.000	3400.000	3900.000	3200.000	.000	.000	.000
5R	15.202	5522.200	20.000	8500.000	10.000	10000.000	10.000	12000.000	.000	15000.000
5A	11.702	19402.000	5.200	20000.000	5.200	20000.102	7.000	20030.000	3.000	20000.000
5B	11.400	20772.000	5.500	20110.000	6.000	20100.000	6.500	20140.000	1.100	20170.000
5C	-1.500	20250.000	-5.100	20320.000	-6.100	20300.000	-10.000	20410.000	-11.100	20440.000
5D	-1.400	20450.000	-4.400	20460.000	10.100	20470.000	13.000	20480.000	10.000	20550.000
5E	11.500	20562.000	10.000	20950.000	5.000	20960.000	10.000	20960.000	12.000	20960.000
5F	11.200	21002.000	21.200	37000.000	30.000	37000.000	.000	.000	.000	.000
61	11.000	41.000	20100.000	20400.000	12000.000	12000.000	17000.000	.000	.000	.000
6R	11.200	5700.000	32.200	11700.000	10.000	11900.000	10.000	14500.000	12.000	17500.000
6A	11.000	19000.000	16.500	20000.000	16.500	20000.102	14.000	20060.000	14.000	20090.000
6B	11.000	20100.000	3.100	20100.000	-1.000	20100.000	-3.700	20130.000	-7.400	20140.000
6C	-1.500	20100.000	-6.500	20230.000	-5.500	20300.000	-4.200	20310.000	-4.000	20330.000
6D	-1.500	20250.000	-4.600	20360.000	-3.400	20390.000	-3.900	20400.000	-2.400	20410.000
6E	-1.500	20450.000	3.100	20450.000	10.000	20460.000	15.000	20480.000	15.000	20510.000
6F	11.000	20550.000	15.400	20570.000	14.000	20570.000	14.000	20570.000	16.000	21270.000
6G	11.000	20750.000	12.200	30075.000	16.000	30175.000	20.000	30000.000	20.000	40000.000
6H	11.000	30000.000	.000	.000	.000	.000	.000	.000	.000	.000
71	11.000	41.000	20100.000	20550.000	12000.000	12000.000	15000.000	.000	.000	.000
7R	11.200	5700.000	30.000	5700.000	20.000	7000.000	10.000	8000.000	10.000	11000.000
7A	11.000	19000.000	14.700	20000.000	16.400	20000.000	16.400	20000.102	16.000	20100.000
7B	11.000	20100.000	10.100	20100.000	8.100	20100.000	3.300	20140.000	1.400	20170.000
7C	-1.500	20250.000	-1.500	20270.000	-4.400	20340.000	-2.400	20400.000	-3.600	20410.000
7D	-1.500	20450.000	-6.400	20500.000	-7.400	20510.000	-1.200	20520.000	1.900	20530.000
7E	11.000	20500.000	12.500	20550.000	16.000	20560.000	18.700	20570.000	20.000	20580.000
7F	11.000	20750.000	17.700	20630.000	20.100	20600.000	20.100	20690.000	22.000	20790.000
7G	11.000	30000.000	10.000	30000.000	15.000	30000.000	20.000	40000.000	30.000	45000.000
81	11.000	20.000	20100.000	20510.000	9000.000	9200.000	11000.000	.000	.000	.000
8R	11.000	1500.000	20.000	1500.000	14.000	3000.000	13.000	10000.000	15.000	19000.000
8A	11.000	19000.000	16.700	20000.000	17.500	20000.000	15.000	20100.000	6.100	20110.000
8B	-1.500	20100.000	-4.100	20140.000	-4.500	20150.000	-3.200	20160.000	-7.400	20170.000
8C	-1.500	20250.000	-4.700	20260.000	-4.400	20410.000	-3.400	20420.000	-3.500	20470.000
8D	-1.500	20450.000	8.400	20500.000	11.200	20510.000	17.000	20520.000	18.200	20540.000
8E	11.000	20550.000	16.400	20655.000	20.000	20630.000	30.000	37020.000	.000	.000
91	11.000	37.000	20100.000	20400.000	5700.000	6700.000	14000.000	.000	.000	.000
9R	11.000	6000.000	27.000	11000.000	19.300	20000.102	10.300	20040.000	19.000	20050.000
9A	11.000	19000.000	13.500	20140.000	10.200	20150.000	3.300	20160.000	.700	20170.000
9B	-1.500	20250.000	-1.200	20190.000	-1.100	20320.000	-1.300	20300.000	-.100	20390.000
9C	-1.500	20450.000	-.900	20400.000	2.700	20440.000	5.500	20450.000	9.300	20460.000
9D	11.000	20450.000	16.300	20460.000	19.900	20500.000	19.900	20500.000	20.000	20500.000
9E	11.000	30000.000	30.000	40500.000	.000	.000	.000	.000	.000	.000
101	11.000	53.000	20100.000	20500.000	4000.000	4700.000	11000.000	.000	.000	.000
10R	11.000	4200.000	20.000	5500.000	20.000	6000.000	22.000	20000.000	15.300	20040.000
10A	11.000	19000.000	19.200	20050.000	17.100	20000.000	17.100	20100.000	11.000	20100.000
10B	11.000	20100.000	6.000	20270.000	6.200	20290.000	5.400	20350.000	1.700	20300.000
10C	-1.500	20250.000	-2.700	20440.000	-6.300	20450.000	-4.000	20460.000	-.600	20470.000
10D	11.000	20450.000	23.100	20500.000	21.700	20500.000	22.700	20520.000	21.100	20520.102
10E	11.000	20550.000	21.500	20550.000	20.900	20570.000	20.900	20570.000	20.000	20670.000
10F	11.000	30000.000	30.000	30670.000	35.000	30670.000	.000	.000	.000	.000

SECNO	DEPTH	CASEL	CRING	ELK	EB	EV	W	LOSS	BRG	ELEV
D	GLOB	GCN	GROR	ALOB	ACH	ACD	VDL	TM	LEFT/RIGHT	
TIME	YLOB	VCN	VROR	YK	YKCH	YKCR	YKTR	ELKIN	65TR	
SCORP	XLOB	XLCN	XLOR	ITRIRL	ITDC	ITCONT	ICORR	TOPWD	ENDST	

*SECNO 32.222
3200 CROSS SECTION 38.00 EXTENDED 19 FEET

38.00	34.15	50.15	.00	.00	56.30	.11	.62	.00		37.30
250000.	36030.	60314.	125656.	64117.	20058.	181614.	1137778.	116788.		33.60
26.50	.56	4.40	.69	.135	.630	.135	.000	15.00		14800.00
000000.	7.22	7900.	5900.	2	0	0	0	.00	16560.00	31760.00

*SECNO 31.222

31.00	42.00	50.50	.00	.00	58.62	.12	.32	.00		37.00
250000.	39000.	69561.	121296.	61031.	19734.	184265.	1160191.	112310.		31.00
27.15	.40	4.54	.66	.135	.630	.135	.000	9.70		11379.97
000000.	3500.	3200.	3600.	0	0	0	0	.00	21305.00	32715.00

*SECNO 30.222

30.00	42.16	51.36	.00	.00	51.51	.15	.09	.01		30.70
250000.	45475.	95396.	105130.	61105.	22371.	101185.	1204027.	115478.		39.50
28.54	.50	4.20	.55	.135	.630	.135	.000	11.20		12759.18
000000.	3000.	3300.	6000.	2	0	0	0	.00	19361.65	32740.00

*SECNO 33.222

33.00	35.94	52.94	.00	.00	53.29	.35	1.72	.06		40.70
250000.	40442.	135916.	73642.	50500.	21194.	93358.	1255936.	119435.		40.70
29.10	.05	6.41	.79	.135	.630	.135	.000	17.00		13521.14
000000.	6000.	15000.	11400.	2	0	0	0	.00	15233.79	28756.93

*SECNO 34.222

3300 - W CHANGED MORE THAN 40 INCH

34.00	42.40	56.46	.00	.00	57.42	.94	3.95	.10		41.00
250000.	33640.	213723.	2677.	33352.	25445.	4280.	1286134.	121779.		40.00
25.61	1.01	0.40	.62	.135	.630	.135	.000	14.00		16207.57
000000.	3200.	20000.	7500.	2	0	0	0	.00	5537.46	21745.93

*SECNO 35.222

3300 - W CHANGED MORE THAN 40 INCH

35.00	42.62	59.62	.00	.00	59.98	.35	2.51	.06		47.40
250000.	87376.	147629.	12995.	104564.	23983.	21409.	1311691.	123549.		39.70
30.54	.84	6.16	.61	.135	.630	.135	.000	17.00		13018.89
000000.	10400.	12700.	6400.	2	0	0	0	.00	10143.55	23162.45

SECDG	DEPTH	CHSEL	CRINS	WSELN	EG	HY	W	GLOSS	DMW	ELEV
Q	Q-DB	QCH	GRDB	A-DB	RCH	ARDB	VDL	TWA	LEFT/RIGHT	
TIME	V-DB	VD-	VRDB	XAL	XNDH	XNR	WTA	ELMH	SSTR	
SLOPE	V-LI	K-DB	X-DBR	TRIAL	IDC	ICENT	CDRAR	TDWID	EXOS7	
*SECDG 36.200										
36.20	42.73	51.33	.00	.00	51.54	.26	1.54	.02		51.40
248000.	21451.	133005.	13504.	159363.	27850.	24750.	1345763.	125000.		52.40
31.97	.63	4.92	.55	.135	.030	.135	.000	18.60		6302.00
.000095	6300.	16002.	0300.	2	0	0	.00	16635.06		23335.06
*SECDG 37.200										
37.20	57.30	52.30	.00	.00	62.41	.10	.65	.61		47.40
248000.	45211.	50156.	4621.	174317.	24724.	28520.	1390492.	126737.		42.60
33.29	.63	3.97	.23	.135	.030	.135	.000	5.60		12666.46
.000263	6307.	14002.	0600.	2	0	0	.00	12944.26		23630.72
*SECDG 38.200										
332: HY CHANGED TO 11 TANK 401NS										
38.20	42.21	54.21	.00	.00	64.75	.74	2.15	.19		54.90
248000.	45211.	155116.	3463.	60702.	25570.	7091.	1453662.	134100.		52.90
34.23	.60	7.17	.44	.135	.030	.135	.000	23.00		11379.50
.000029	13702.	20002.	10702.	2	0	0	.00	11302.46		22602.04
*SECDG 39.200										
39.20	47.33	55.03	.00	.00	66.50	.75	1.63	.00		57.60
248000.	30220.	210077.	4905.	53845.	27906.	9339.	1179022.	135781.		57.60
34.55	.62	7.53	.50	.135	.030	.135	.000	18.50		12683.30
.000026	1450.	9002.	6150.	2	0	0	.00	9755.24		22430.35
*SECDG 40.200										
40.20	35.70	57.50	.00	.00	60.60	.80	2.00	.02		51.10
248000.	30474.	200231.	15233.	42725.	25024.	21596.	1490591.	137622.		49.00
35.05	.70	7.19	.70	.135	.030	.135	.000	26.10		15642.40
.000135	9102.	9500.	9002.	2	0	0	.00	7047.00		21409.40
*SECDG 41.200										
41.20	50.26	71.16	.00	.00	71.70	.54	2.99	.03		45.40
248000.	16752.	200022.	21177.	32451.	30565.	31129.	1520090.	139700.		47.90
35.05	.03	8.54	.60	.135	.030	.135	.000	21.10		17672.21
.000145	13100.	17400.	11700.	2	0	0	.00	6039.40		23711.02

SECD	DEPTH	CHSEL	CRIMS	MSL	ES	W	W	DLOS	BRK	ELF
Q	GLOB	ACH	DRGB	ALOB	ACH	ACOS	W	TH	LEFT	RIGHT
TIME	VLOB	VEN	VRGB	XK	YCH	TRF	WTR	ELKIN	BSR	
SLOPE	VGBL	YLCR	XLOBR	ITRIN	IND	ICONT	CONR	TOPWID	EDGE	

19SDAS 41.500

41.52	47.52	71.72	.20	.00	72.42	.76	.67	.85	48.59	
248022.	23411.	288293.	16496.	26493.	26458.	24253.	153853.	148244.	55.00	
35.27	.86	7.31	.68	.135	.638	.135	.800	24.28	1729.38	
.220139	4007.	4022.	4000.	2	6	0	.04	5785.68	23645.23	

 MEMO RELEASE DATED NOV 76 UPDATED MAY 1984
 ERROR CORR - 01, 02, 03, 04, 05, 06
 MODIFICATION - 50, 51, 52, 53, 54, 55, 56

NOTE: ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

APALACHICOLA R. (76.8 MI)

SUMMARY OF TABLE 152

CROSS-SECTION	DATE	ELTD	ELEC	ELWIN	Q	CASEL	CRIMS	EG	10K+5	VCH	AREA	.01K
12.722	12.722	.22	.00	-13.60	257000.00	20.14	.00	20.20	.74	3.96	438724.87297953.19	
13.722	13.722	.22	.00	-19.10	257000.00	21.43	.00	21.54	1.36	5.24	313168.00220354.19	
14.202	14.202	.22	.00	-17.50	257000.00	22.81	.00	22.94	1.20	5.60	325592.94234197.69	
15.200	15.200	.22	.00	-11.10	257000.00	23.29	.00	23.35	1.00	4.59	347695.94246852.56	
16.202	16.202	.22	.00	-6.50	257000.00	24.63	.00	24.60	.66	4.30	365542.62273557.50	
17.202	17.202	.22	.00	-9.10	257000.00	25.66	.00	25.72	.75	3.87	438900.31297614.25	
18.722	18.722	.22	.00	-7.40	257000.00	26.57	.00	26.69	1.36	5.46	314107.8720121.69	
19.722	19.722	.22	.00	-1.30	257000.00	28.50	.00	28.92	3.66	6.37	230460.01134334.19	
20.200	20.200	.22	.00	-6.30	257000.00	30.60	.00	30.75	2.28	6.15	266106.31177190.56	
21.200	21.200	.22	.00	-4.00	257000.00	31.32	.00	31.40	1.40	4.99	323078.06210921.87	
22.200	22.200	.00	.00	-2.60	257000.00	31.81	.00	31.95	2.42	5.81	267234.94165126.37	
23.200	23.200	.22	.22	-5.90	250000.00	32.62	.00	32.66	.69	3.90	365922.94265716.31	
24.222	24.222	.22	.22	5.40	250000.00	34.85	.00	34.90	1.38	4.97	288702.12213035.75	
25.202	25.202	.22	.22	2.80	250000.00	38.35	.00	38.89	3.72	8.33	157749.12129691.62	
26.202	26.202	.22	.22	2.60	250000.00	41.29	.00	41.41	1.29	5.26	292144.25219923.56	
27.222	27.222	.22	.00	3.90	250000.00	43.82	.00	44.14	2.21	6.74	169859.44168323.50	
28.222	28.222	.00	.00	7.40	250000.00	46.16	.00	46.95	3.75	8.77	130627.50129037.56	

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SECNO	X.Ch	ELTRD	ELLC	ELNIN	D	CHSEL	DRMS	EB	ENRGE	VCN	AREA	.B1K
29.222	22200.00	.00	.00	1.00	250000.00	49.57	.00	49.60	.90	4.09	202311.61262062.62	
30.222	7500.00	.00	.00	15.00	250000.00	50.19	.00	50.30	.91	4.00	265800.19261363.50	
31.222	3200.00	.00	.00	9.70	250000.00	50.50	.00	50.62	.92	4.90	265051.06260472.67	
32.222	13200.00	.00	.00	11.20	250000.00	51.05	.00	51.51	1.04	4.00	262651.94245065.10	
33.222	15000.00	.00	.00	17.00	250000.00	52.94	.00	53.29	1.63	6.40	173131.44184959.52	
34.222	22000.00	.00	.00	14.00	250000.00	55.40	.00	57.42	3.04	6.40	63065.27143448.94	
35.220	12700.00	.00	.00	17.00	240000.00	55.62	.00	55.92	1.53	0.00	149956.06202391.00	
36.222	10200.00	.00	.00	10.60	240000.00	61.33	.00	61.54	.90	4.92	211772.07255024.19	
37.222	14200.00	.00	.00	5.00	240000.00	62.30	.00	62.41	.63	3.97	219360.31313648.61	
38.222	20500.00	.00	.00	13.60	240000.00	64.01	.00	64.75	2.20	7.07	102503.25167065.00	
39.222	5000.00	.00	.00	10.50	240000.00	65.63	.00	66.30	2.06	7.33	91123.13171961.31	
40.222	9500.00	.00	.00	20.10	240000.00	67.60	.00	68.60	2.35	7.95	89445.06161702.75	
41.222	17400.00	.00	.00	21.10	240000.00	71.16	.00	71.72	1.43	6.54	94164.25206197.75	
42.222	4200.00	.00	.00	24.20	240000.00	71.72	.00	72.42	1.99	7.31	79203.65175965.67	

APALAC-TCOLA R. (75. B P1)

SUMMARY PRINTOUT TABLE 190

SECNO	D	CWSEL	DIFWSP	DIFWST	DIFWAK	TOPWTS	ALL
12.000	257000.00	20.14	.00	.00	.00	1715.43	.00
13.000	257000.00	21.43	.00	1.29	.00	29144.57	16400.00
14.000	257000.00	22.61	.00	1.36	.00	30230.05	11900.00
15.000	257000.00	23.75	.00	.46	.00	30575.00	3200.00
16.000	257000.00	24.63	.00	1.33	.00	34520.02	17600.00
17.000	257000.00	25.66	.00	1.05	.00	39036.30	15600.00
18.000	257000.00	26.57	.00	.09	.00	32310.07	11500.00
19.000	257000.00	28.50	.00	0.01	.00	32533.94	14100.00
20.000	257000.00	22.60	.00	0.02	.00	27330.03	11600.00
21.000	257000.00	21.21	.00	.72	.00	29442.00	5700.00
22.000	257000.00	21.21	.00	.49	.00	30620.90	2300.00
23.000	250000.00	22.62	.00	.61	.00	31742.49	6300.00
24.000	250000.00	24.65	.00	2.24	.00	32372.69	26900.00
25.000	250000.00	26.35	.00	3.49	.00	18777.19	24000.00
26.000	250000.00	41.29	.00	2.94	.00	25681.39	15000.00
27.000	250000.00	43.02	.00	2.53	.00	14047.46	21000.00
28.000	250000.00	46.16	.00	2.34	.00	19233.55	11600.00
29.000	250000.00	49.57	.00	3.40	.00	19650.00	22000.00
30.000	250000.00	50.19	.00	.62	.00	16960.00	7900.00
31.000	250000.00	52.50	.00	.31	.00	21335.05	3000.00
32.000	250000.00	51.30	.00	.05	.00	19901.05	12000.00
33.000	250000.00	52.54	.00	1.50	.00	12213.79	15000.00
34.000	250000.00	56.40	.00	3.54	.00	5537.46	20000.00
35.000	240000.00	55.62	.00	3.14	.00	10143.55	12700.00

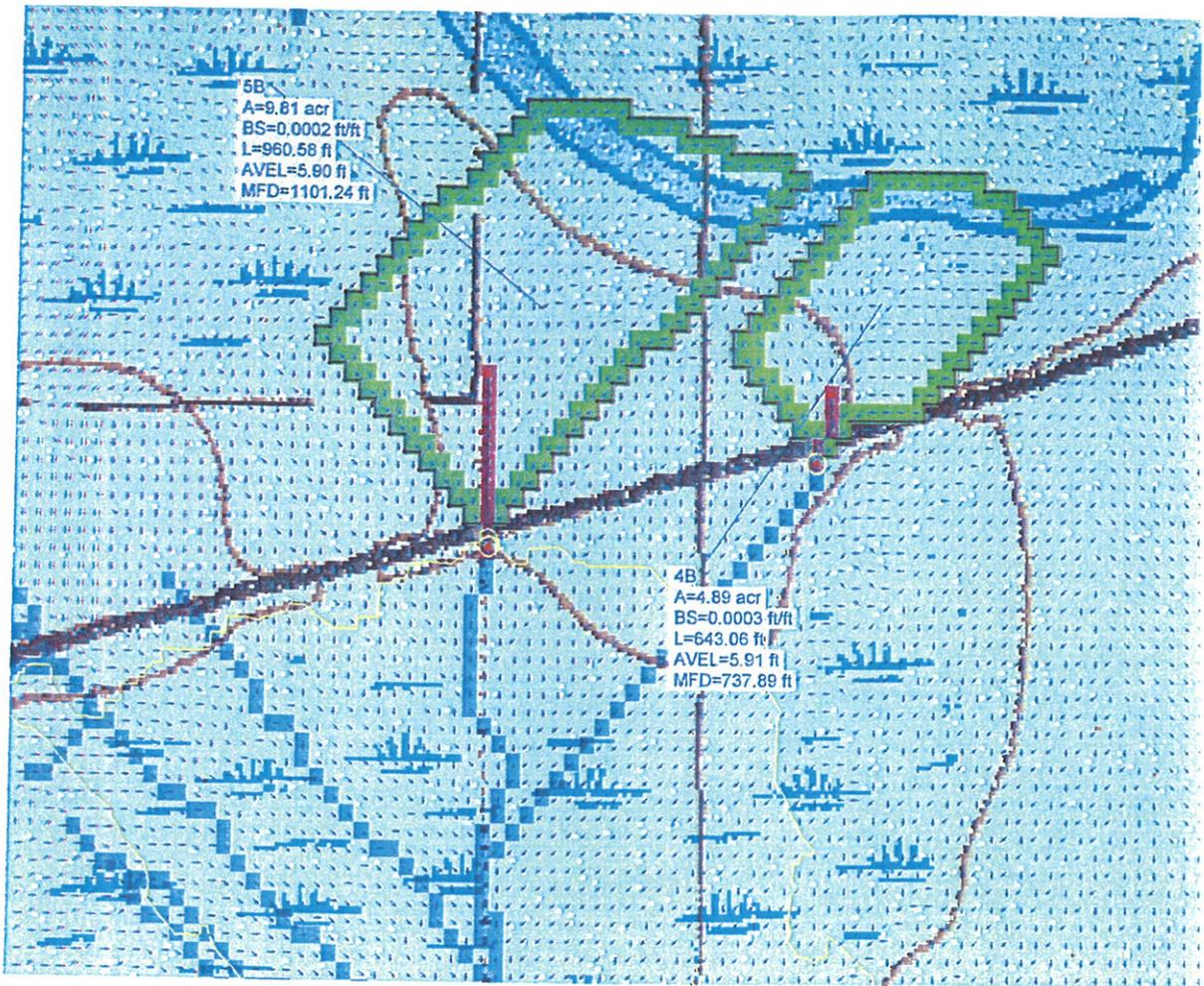
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SECNO	Q	CHSEL	DIFMS2	DIFMS1	DIFMS0	TOP410	TOTL
36.000	246000.00	61.33	.00	1.71	.00	1255.45	1000.00
37.000	246000.00	62.36	.00	.97	.00	1234.75	1000.00
38.000	246000.00	64.01	.00	1.71	.00	1122.45	1000.00
39.000	246000.00	65.63	.00	1.82	.00	975.41	900.00
40.000	246000.00	67.66	.00	2.85	.00	7647.88	5500.00
41.000	246000.00	71.16	.00	3.26	.00	6839.48	17400.00
42.000	246000.00	73.72	.00	.56	.00	5789.66	4000.00

FL PFH 12-1(1) River Styx Bridge Replacement

APPENDIX B - HYDROLOGY





Display

Type: Basins

Show: Selected

Units: English

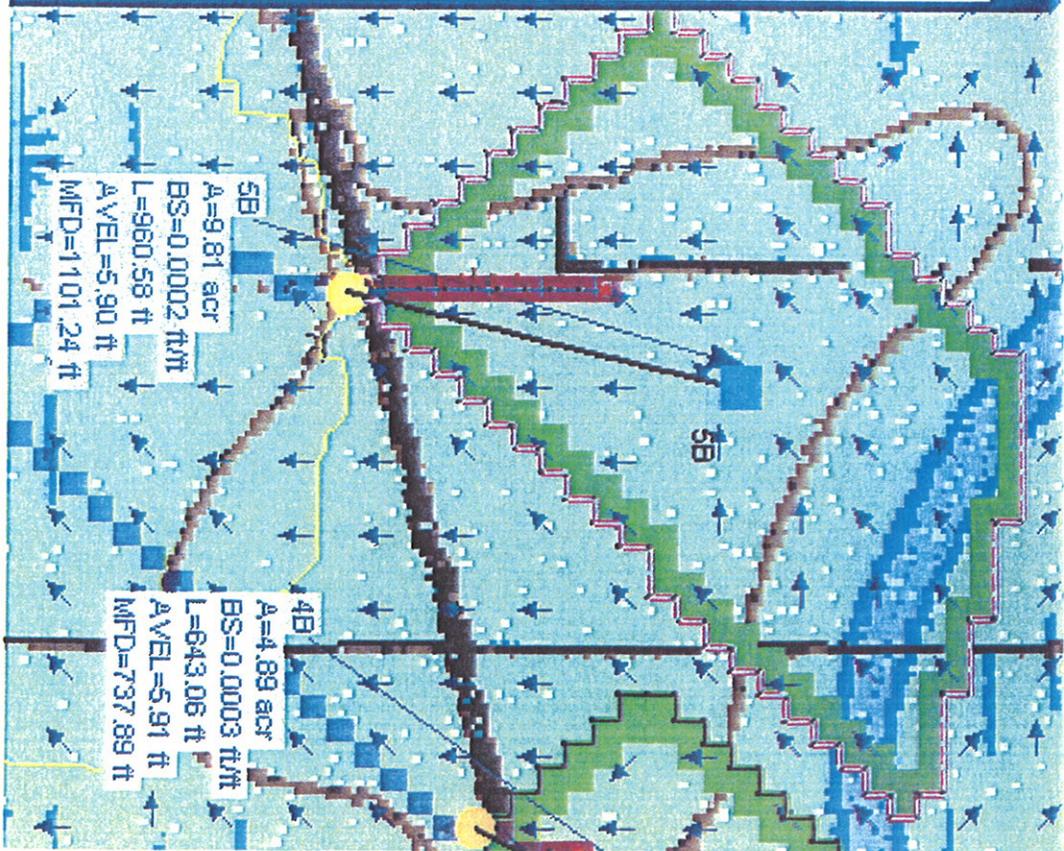
Parameters

Parameter	Basin	Units
Name	5B	
Runoff Coefficient (C)	0.4500	[Dimensionless]
Rainfall Intensity (I)	7.650	[in/hr]
Compute I - IDF Curves	Comput...	
Area (A)	9.81	[acres]
Time of concentration (Tc)	47.000	[minutes]
Compute Tc - Basin Data	Comput...	
Compute Tc - Map Data	Comput...	
Flowrate (Q)	34.052	[cfs]
Compute Hydrographs	Comput...	

Help...

OK

Cancel



Rational Method

Display

Type: Basins

Show: Selected

Units

English

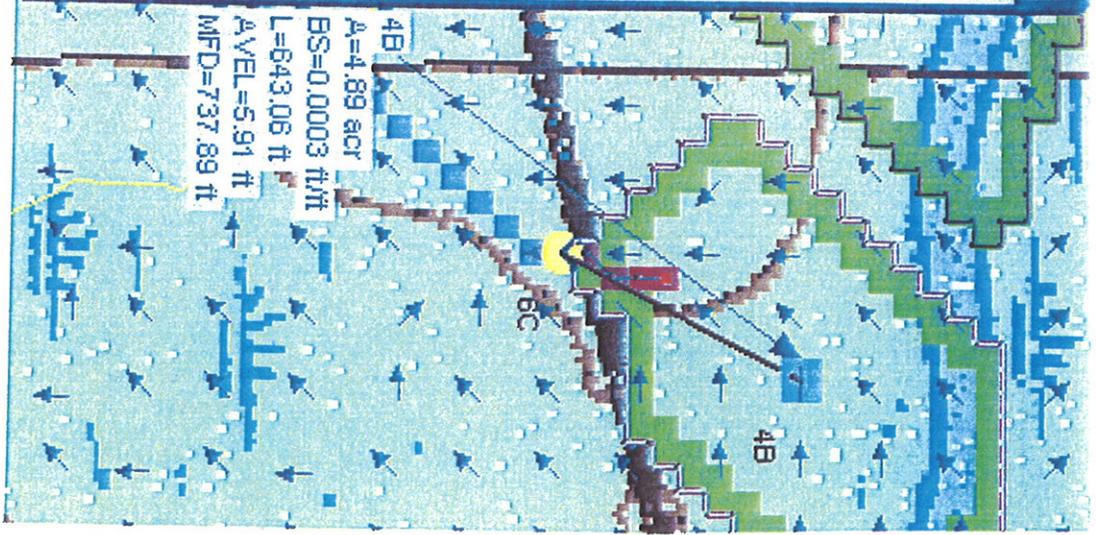
Parameters

Parameter	Basin	Units
Name	4B	
Runoff Coefficient (C)	0.4500	[Dimensionless]
Rainfall Intensity (I)	7.650	[in/hr]
Compute I - IDF Curves	Comput...	
Area (A)	4.89	[acres]
Time of concentration (Tc)	32.000	[minutes]
Compute Tc - Basin Data	Comput...	
Compute Tc - Map Data	Comput...	
Flowrate (Q)	16.974	[cfs]
Compute Hydrographs	Comput...	

Help...

OK

Cancel



Project: Design Example
 Date: 3/24/2007
 By: TED NGUYEN
 Checked:

Latitude Longitude
 (decimal) (decimal)
 Begin project: 33.063 -85.063
 End project:
 Average: 33.060 -85.060

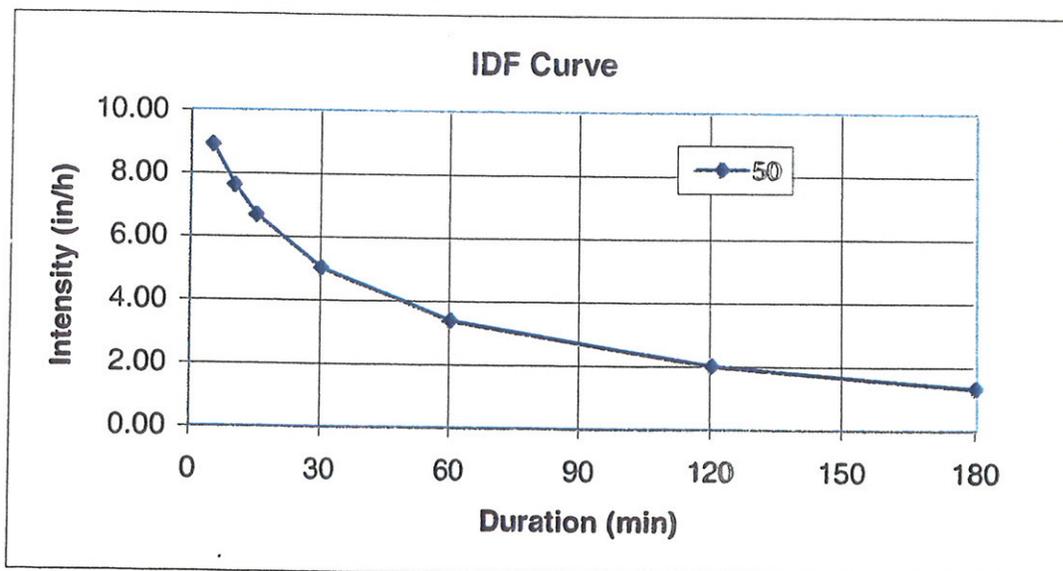
User Input Data

Imported Table from NOAA Atlas 14 for Latitude Longitude (if available):

Precipitation Depth Estimates (in)										
AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr
2	0.41	0.66	0.83	1.15	1.44	1.72	1.85	2.24	2.67	3.06
5	0.52	0.83	1.05	1.49	1.92	2.31	2.49	3	3.6	4.15
10	0.59	0.93	1.18	1.71	2.23	2.72	2.93	3.55	4.3	4.98
25	0.66	1.05	1.33	1.98	2.63	3.26	3.52	4.3	5.28	6.17
50	0.71	1.13	1.43	2.16	2.92	3.67	3.96	4.9	6.08	7.16
100	0.76	1.21	1.53	2.34	3.22	4.11	4.43	5.54	6.96	8.26
200	0.8	1.27	1.61	2.5	3.51	4.54	4.89	6.21	7.91	9.46
500	0.86	1.35	1.7	2.71	3.89	5.14	5.54	7.17	9.3	11.26
1000	0.89	1.41	1.77	2.86	4.18	5.59	6.03	7.94	10.47	12.77
P2,24 (in)	3.06	2-yr 24 h rainfall from NOAA Atlas 14								
P2,24 (in)		from alternative source if NOAA Atlas 14 not available								
P2,24 (in)	3.06	value to use								

Design IDF Curve (in/h)

Duration (min)	5	10	15	30	60	120	180	360	720	1440
Design (yr)										
50	8.52	6.78	5.72	4.32	2.92	1.84	1.32	0.82	0.51	0.30
50	8.91	7.62	6.68	5.02	3.38	2.01	1.20	0.72	0.43	0.32
50	8.91	7.62	6.68	5.02	3.38	2.01	1.32	0.82	0.51	0.32



Project: Design Example

Date: 3/24/2007

By: TED NGUYEN

Checked:

Latitude Longitude
(decimal) (decimal)

Begin project: 33.063 -85.063

End project:

Average: 33.060 -85.060

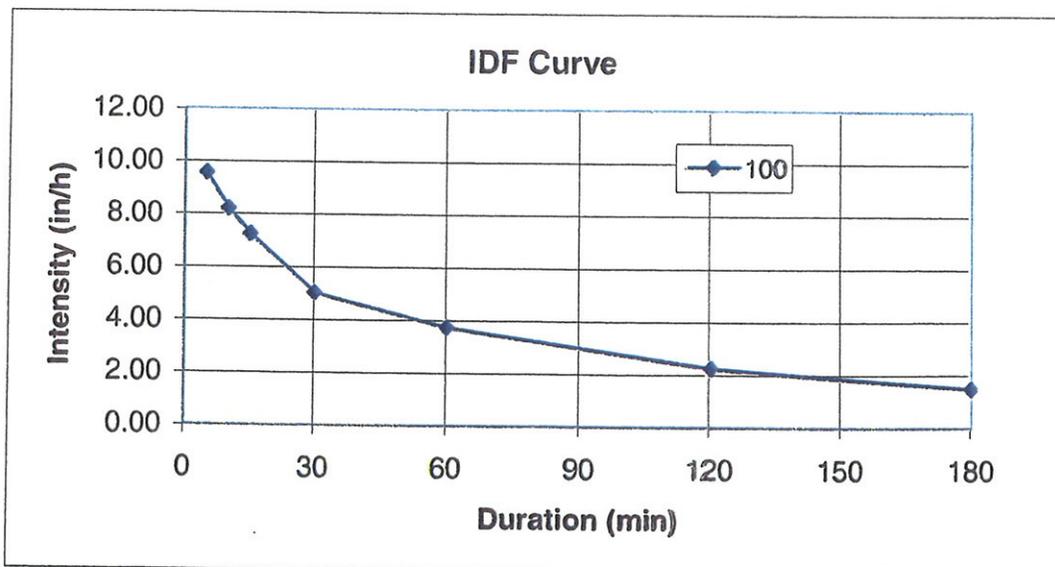
User Input Data

Imported Table from NOAA Atlas 14 for Latitude Longitude (if available):

Precipitation Depth Estimates (in)										
AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr
2	0.41	0.66	0.83	1.15	1.44	1.72	1.85	2.24	2.67	3.06
5	0.52	0.83	1.05	1.49	1.92	2.31	2.49	3	3.6	4.15
10	0.59	0.93	1.18	1.71	2.23	2.72	2.93	3.55	4.3	4.98
25	0.66	1.05	1.33	1.98	2.63	3.28	3.52	4.3	5.28	6.17
50	0.71	1.13	1.43	2.16	2.92	3.67	3.96	4.9	6.08	7.16
100	0.76	1.21	1.53	2.34	3.22	4.1	4.43	5.54	6.96	8.26
200	0.8	1.27	1.61	2.5	3.51	4.54	4.89	6.21	7.91	9.46
500	0.86	1.35	1.7	2.71	3.89	5.14	5.54	7.17	9.3	11.26
1000	0.89	1.41	1.77	2.86	4.18	5.58	6.03	7.94	10.47	12.77
P2,24 (in)	3.06	2-yr 24 h rainfall from NOAA Atlas 14								
P2,24 (in)		from alternative source if NOAA Atlas 14 not available								
P2,24 (in)	3.06	value to use								

Design IDF Curve (in/h)

Duration (min)	5	10	15	30	60	120	180	360	720	1440
Design (yr)										
100	9.12	7.26	6.12	4.68	3.22	2.05	1.48	0.92	0.58	0.34
100	9.57	8.20	7.25	5.02	3.73	2.22	1.32	0.79	0.47	0.35
100	9.57	8.20	7.25	5.02	3.73	2.22	1.48	0.92	0.58	0.35



50 yrs

***** HYDRO - Version 6.1 *****
* HEC19 / Design Event vs Return Period Program *
* Date of Run: 02-28-2007 *

Page No 1

Rainfall Intensity and Duration

--- Input File: C:\HYDRO\RIVERSTY.HDO

IDF RIVER STYX BRIDGE

=== IDF CURVE Option Selected ...

LOC 33 06 85 06

--- The Latitude is 33 degrees, 6 minutes.

--- The Longitude is 85 degrees, 6 minutes.

RPD 50

--- The Selected Return Period is 50 years.

+++ End of HYDRO Command File

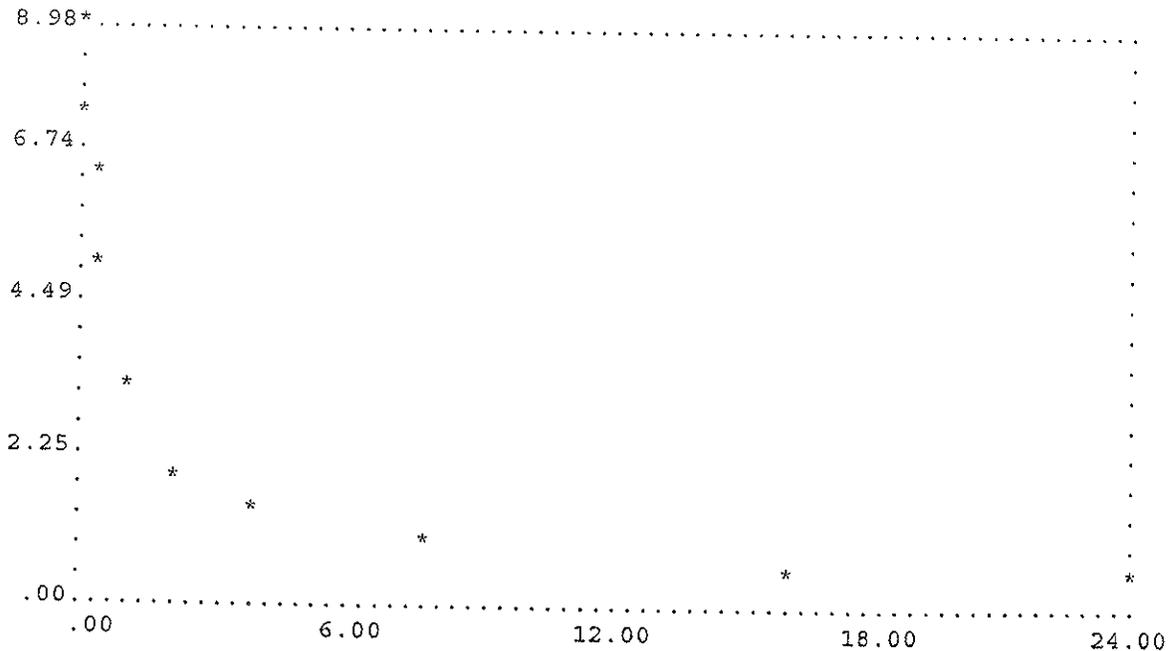
Rainfall Intensity and Duration

 IDF Curve for Various Return Periods

Intensities (in/h)

Duration	50 Yr	2 Yr	5 Yr	10 Yr	25 Yr	100 Yr
5 min	8.981	5.998	6.925	7.537	8.367	9.569
10 min	7.623	4.804	5.660	6.236	7.028	8.199
15 min	6.679	3.974	4.781	5.331	6.097	7.247
30 min	5.018	2.793	3.441	3.891	4.528	5.502
60 min	3.379	1.790	2.244	2.564	3.022	3.734
120 min	2.013	1.071	1.340	1.530	1.802	2.224
4 h	1.200	.641	.800	.913	1.074	1.324
8 h	.715	.384	.478	.544	.640	.789
16 h	.426	.230	.285	.325	.382	.470
24 h	.315	.170	.211	.240	.282	.347

RIVER STYX BRIDGE
 Intensity Curve for 50 Year Return Period
 Rainfall Intensity (in/h) versus Duration (h)



***** HYDRO ***** (Version 6.1) *****

Date 02-28-2007

Page No 3

Rainfall Intensity and Duration

+++ Notice: Intermediate file has English units.

=== File Created on Intermediate Directory: RIVERSTY.IDF

+++ NORMAL END OF HYDRO

100-yrs

***** HYDRO - Version 6.1 *****
* HEC19 / Design Event vs Return Period Program *
* Date of Run: 02-28-2007 *

Rainfall Intensity and Duration

--- Input File: C:\HYDRO\RIVERFL.HDO

IDF RIVER STYX BRIDGE

=== IDF CURVE Option Selected ...

LOC 33 06 85 06

--- The Latitude is 33 degrees, 6 minutes.

--- The Longitude is 85 degrees, 6 minutes.

RPD 100

--- The Selected Return Period is 100 years.

+++ End of HYDRO Command File

Rainfall Intensity and Duration

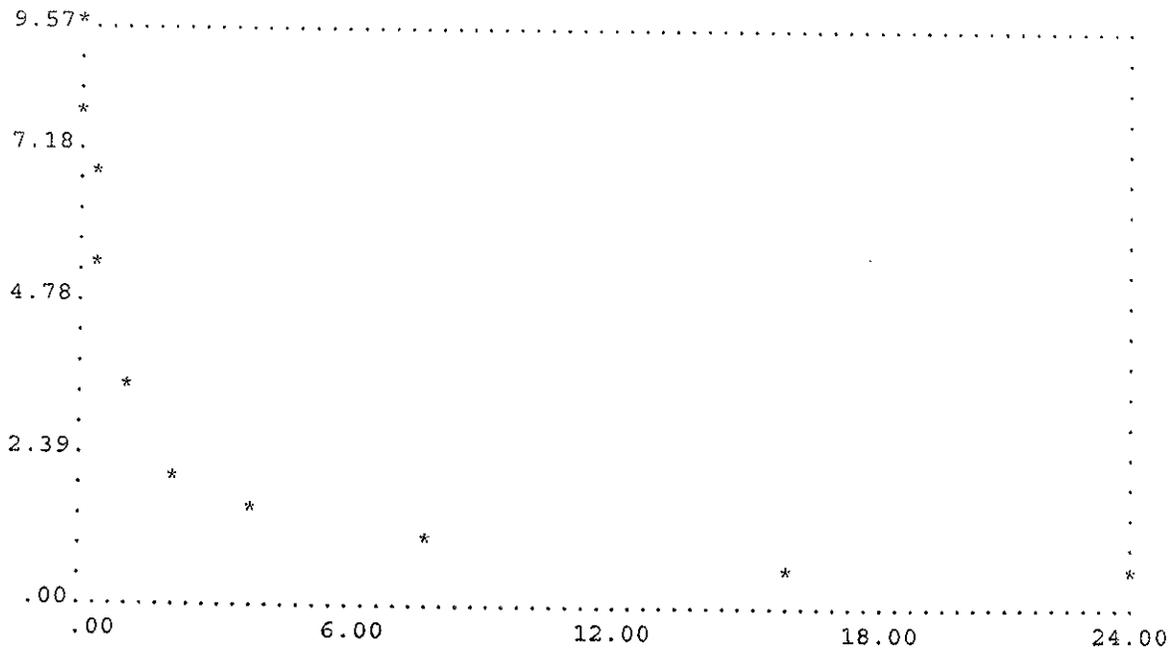
IDF Curve for Various Return Periods

Intensities (in/h)

Duration	100 Yr	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr
5 min	9.569	5.998	6.925	7.537	8.367	8.981
10 min	8.199	4.804	5.660	6.236	7.028	7.623
15 min	7.247	3.974	4.781	5.331	6.097	6.679
30 min	5.502	2.793	3.441	3.891	4.528	5.018
60 min	3.734	1.790	2.244	2.564	3.022	3.379
120 min	2.224	1.071	1.340	1.530	1.802	2.013
4 h	1.324	.641	.800	.913	1.074	1.200
8 h	.789	.384	.478	.544	.640	.715
16 h	.470	.230	.285	.325	.382	.426
24 h	.347	.170	.211	.240	.282	.315

6 hr .512

RIVER STYX BRIDGE
Intensity Curve for 100 Year Return Period
Rainfall Intensity (in/h) versus Duration (h)



***** HYDRO ***** (Version 6.1) *****

Date 02-28-2007

Page No 3

Rainfall Intensity and Duration

+++ Notice: Intermediate file has English units.

=== File Created on Intermediate Directory: RIVERFL.IDF

+++ NORMAL END OF HYDRO

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

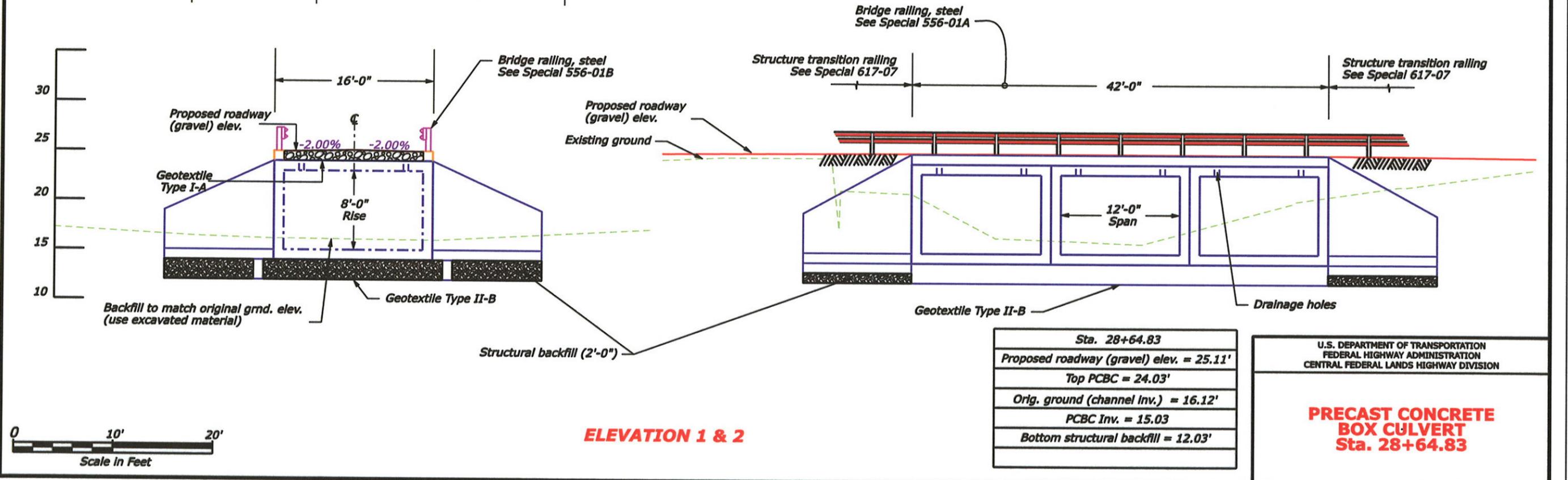
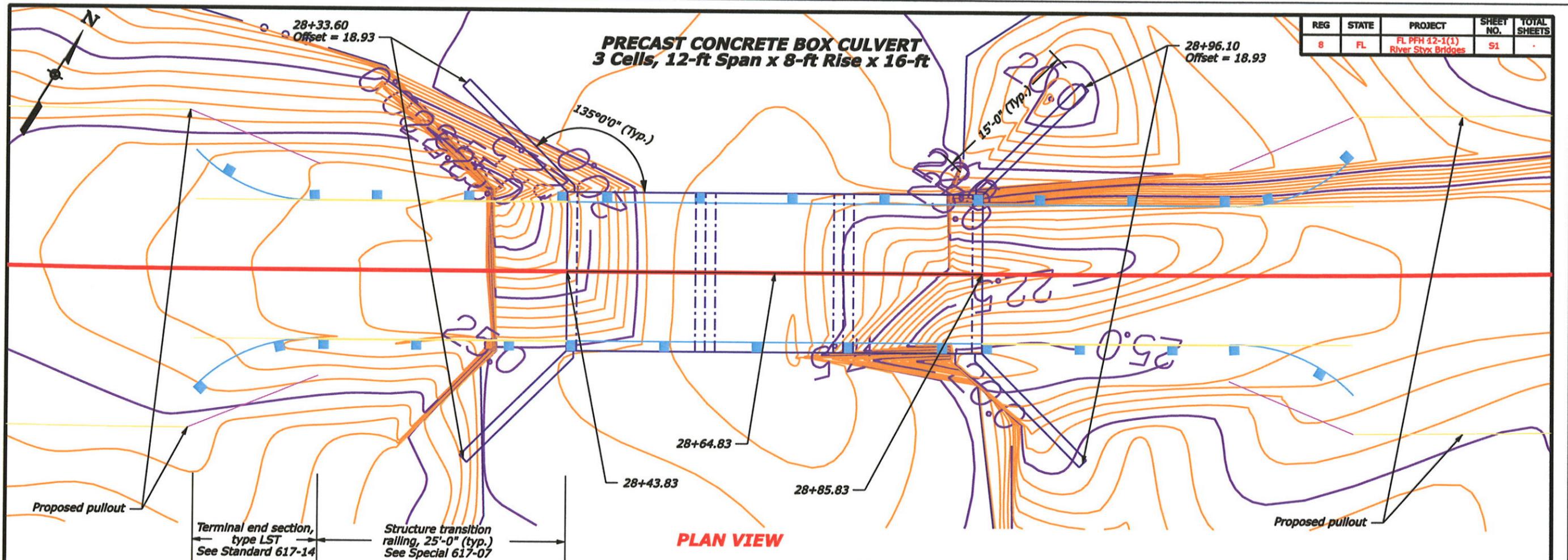
TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS)			
		10-YEAR	50-YEAR	100-YEAR	500-YEAR
APALACHICOLA RIVER					
at Sumatra stream gage	19,200	169,000	230,000	257,000	322,000
at Wawahichka stream gage	17,800	163,000	222,000	250,000	314,000
at Blountstown stream gage	17,600	160,000	220,000	248,000	313,000
TELOGIA CREEK					
about 0.57 mile upstream of mouth	246.0	8,800	16,000	19,700	30,500
about 2,200 feet upstream of confluence of Yellow Creek	224.0	8,500	15,200	18,700	28,900
about 400 feet downstream of confluence of Barbeque Branch	214.0	8,300	14,800	18,200	28,000
about 1,000 feet downstream of confluence of Driver Branch	203.0	8,000	14,300	17,600	27,100
about 2,100 feet downstream of State Road 65	179.0	7,300	12,900	15,800	24,100
CAMP BRANCH					
at mouth	3.3	400	700	900	1,250
just upstream of State Road 379	2.7	350	600	750	1,100
about 2,100 feet upstream of State Road 379	2.3	300	550	650	950
just upstream of State Road 379A	1.9	200	400	500	650
about 0.8 mile upstream of State Road 379A	1.3	100	250	300	350

APPENDIX C – PROPOSED BOX CULVERTS

REG	STATE	PROJECT	SHEET NO.	TOTAL SHEETS
8	FL	FL PFH 12-1(1) River Styx Bridges	S1	

**PRECAST CONCRETE BOX CULVERT
3 Cells, 12-ft Span x 8-ft Rise x 16-ft**

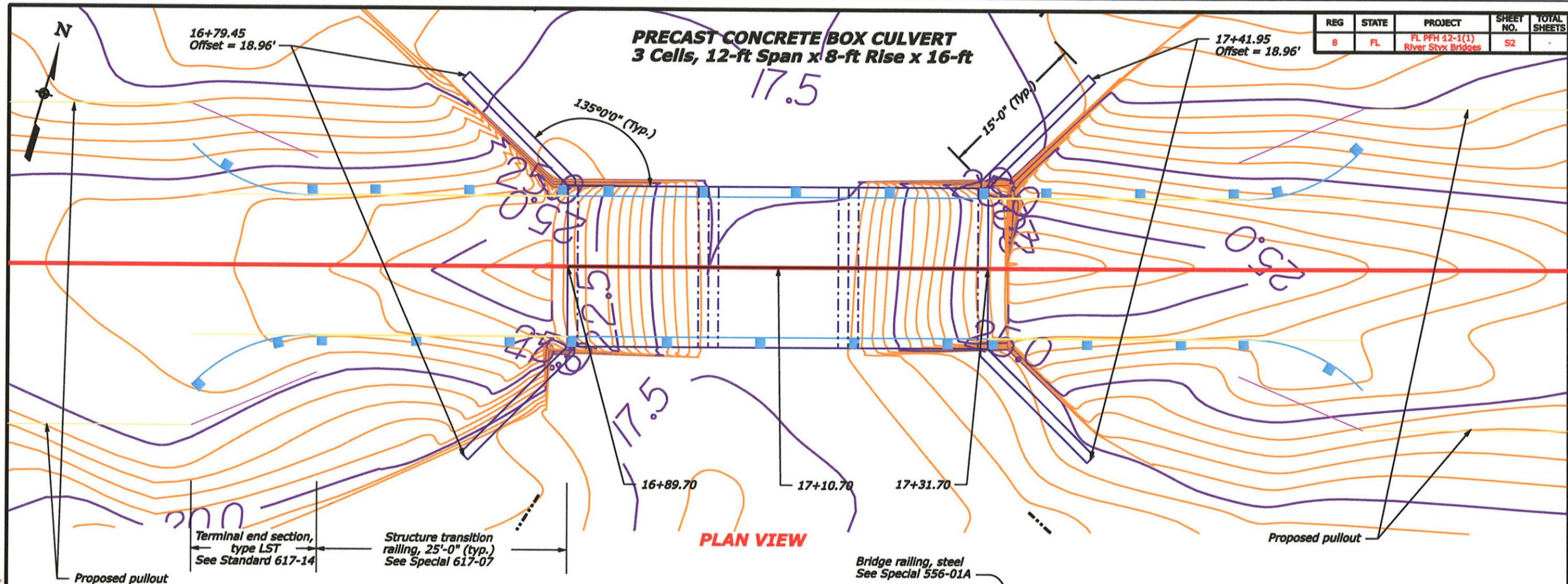


U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL FEDERAL LANDS HIGHWAY DIVISION

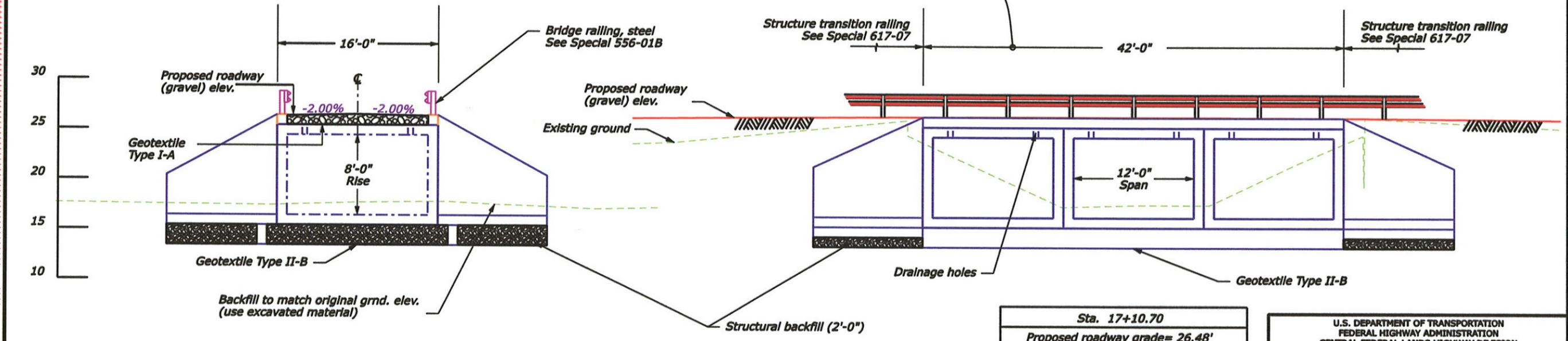
**PRECAST CONCRETE
BOX CULVERT
Sta. 28+64.83**

REG	STATE	PROJECT	SHEET NO.	TOTAL SHEETS
8	FL	FL PFH 12-1(1) River Styx Bridges	S2	

PRECAST CONCRETE BOX CULVERT
3 Cells, 12-ft Span x 8-ft Rise x 16-ft



PLAN VIEW

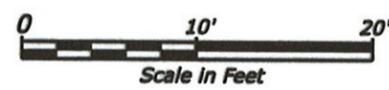


ELEVATION 1 & 2

Sta. 17+10.70
Proposed roadway grade = 26.48'
Top PCBC = 25.42'
Orig. ground (channel inv.) = 17.69'
PCBC Invert = 16.42'
Bottom structural backfill = 13.42'

U.S. DEPARTMENT OF TRANSPORTATION
 FEDERAL HIGHWAY ADMINISTRATION
 CENTRAL FEDERAL LANDS HIGHWAY DIVISION

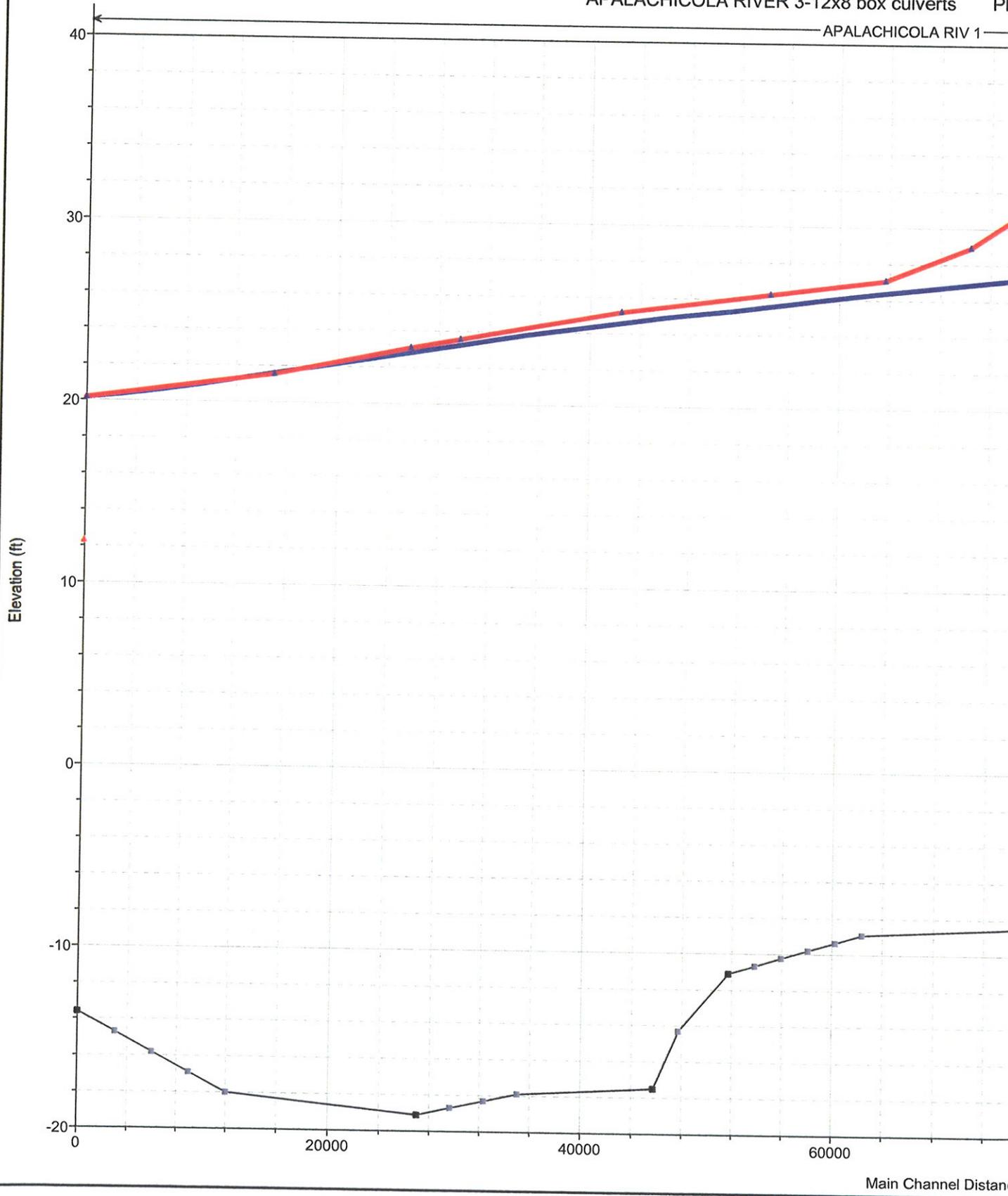
PRECAST CONCRETE BOX CULVERT
Sta. 17+10.70



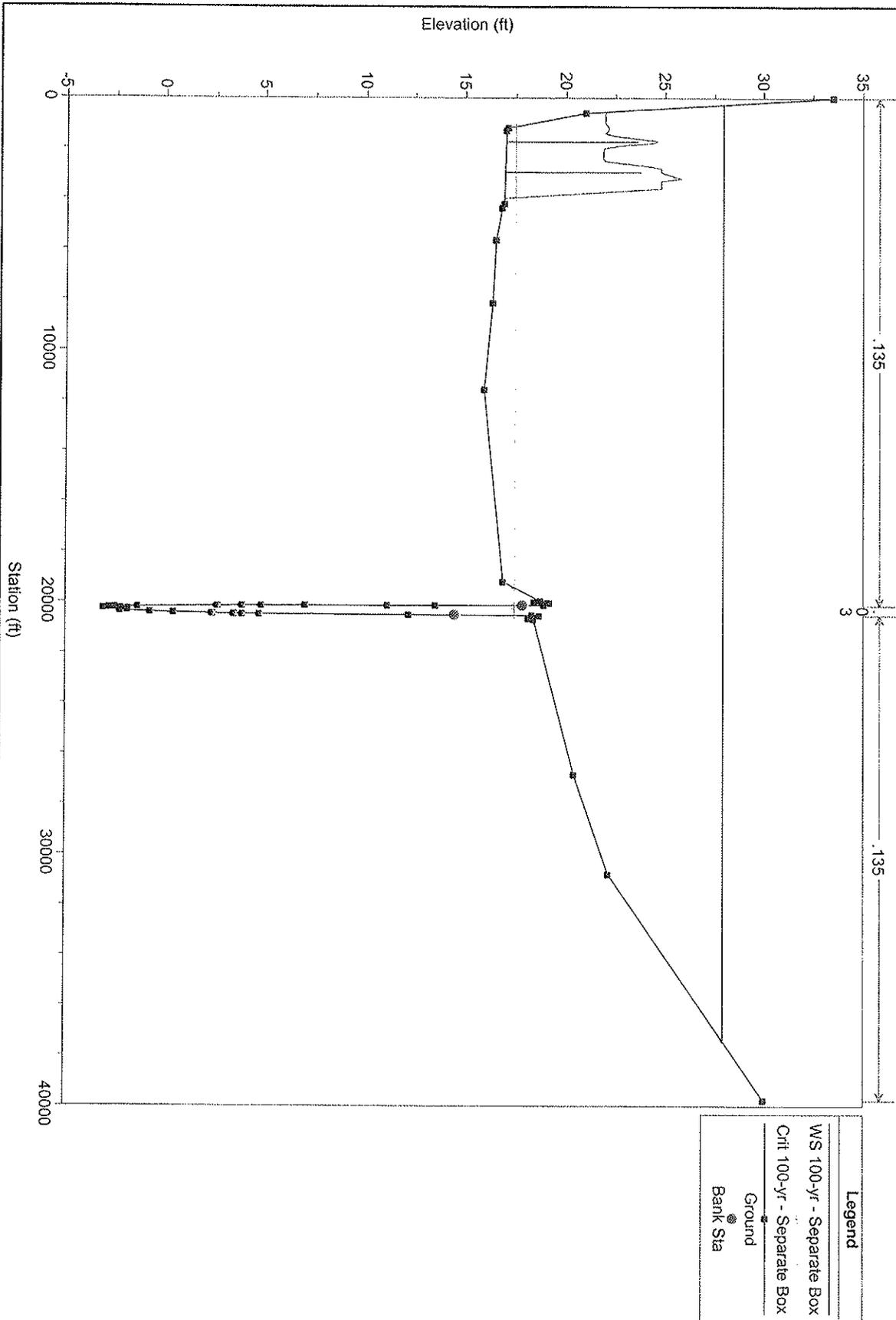
**APPENDIX D – BRIDGE/BOX CULVERTS
HYDRAULICS**

APALACHICOLA RIVER 3-12x8 box culverts

APALACHICOLA RIV 1



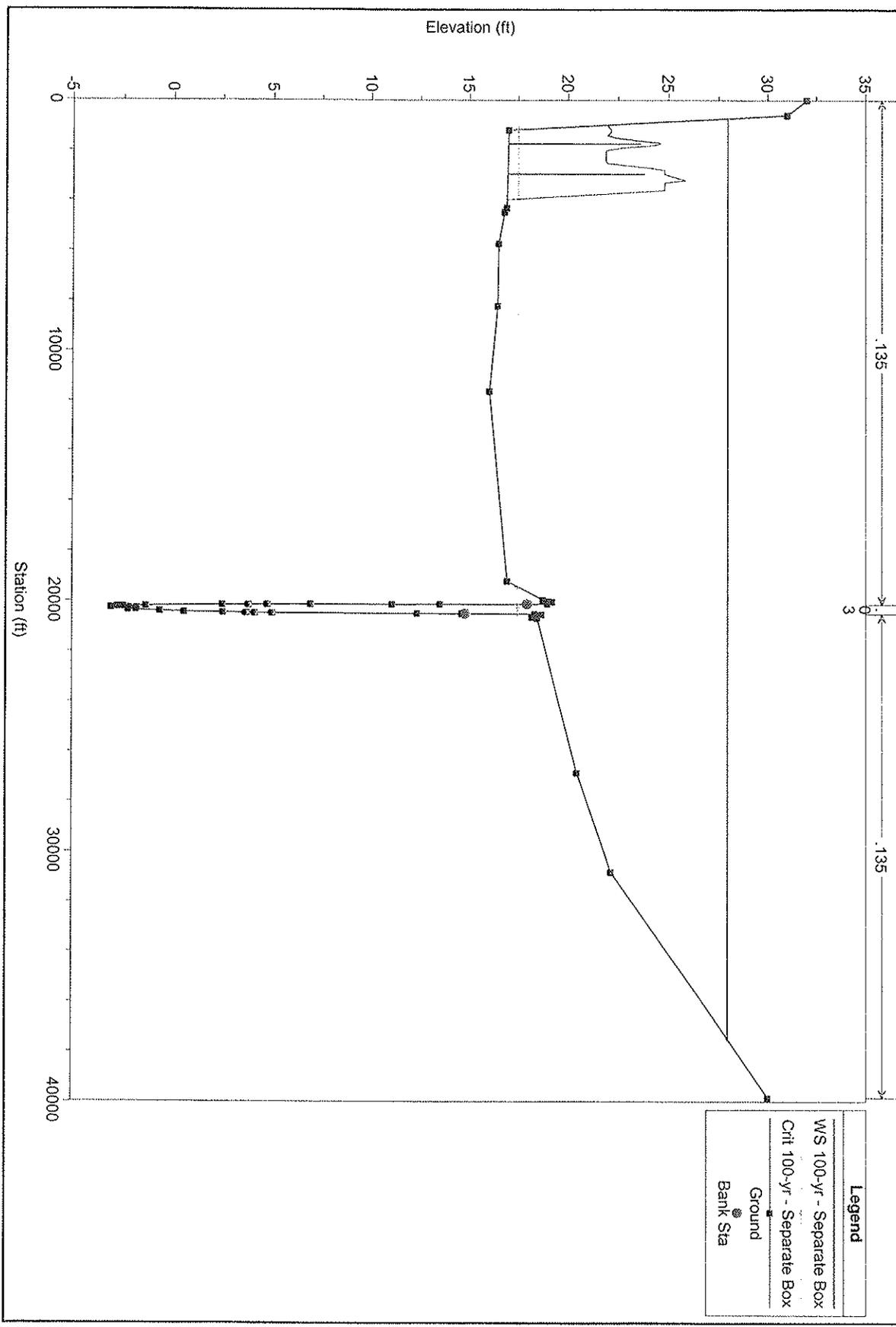
APALACHICOLA RIVER 4-16x8 box culverts Plan: 1) Separate Box 8/17/2007 2) FEMA DE 8/15/2007
 River = APALACHICOLA RIV Reach = 1 RS = 18.4679 MO Existing bridges



Legend
 WS 100-yr - Separate Box
 Crit 100-yr - Separate Box
 Ground
 Bank Sta

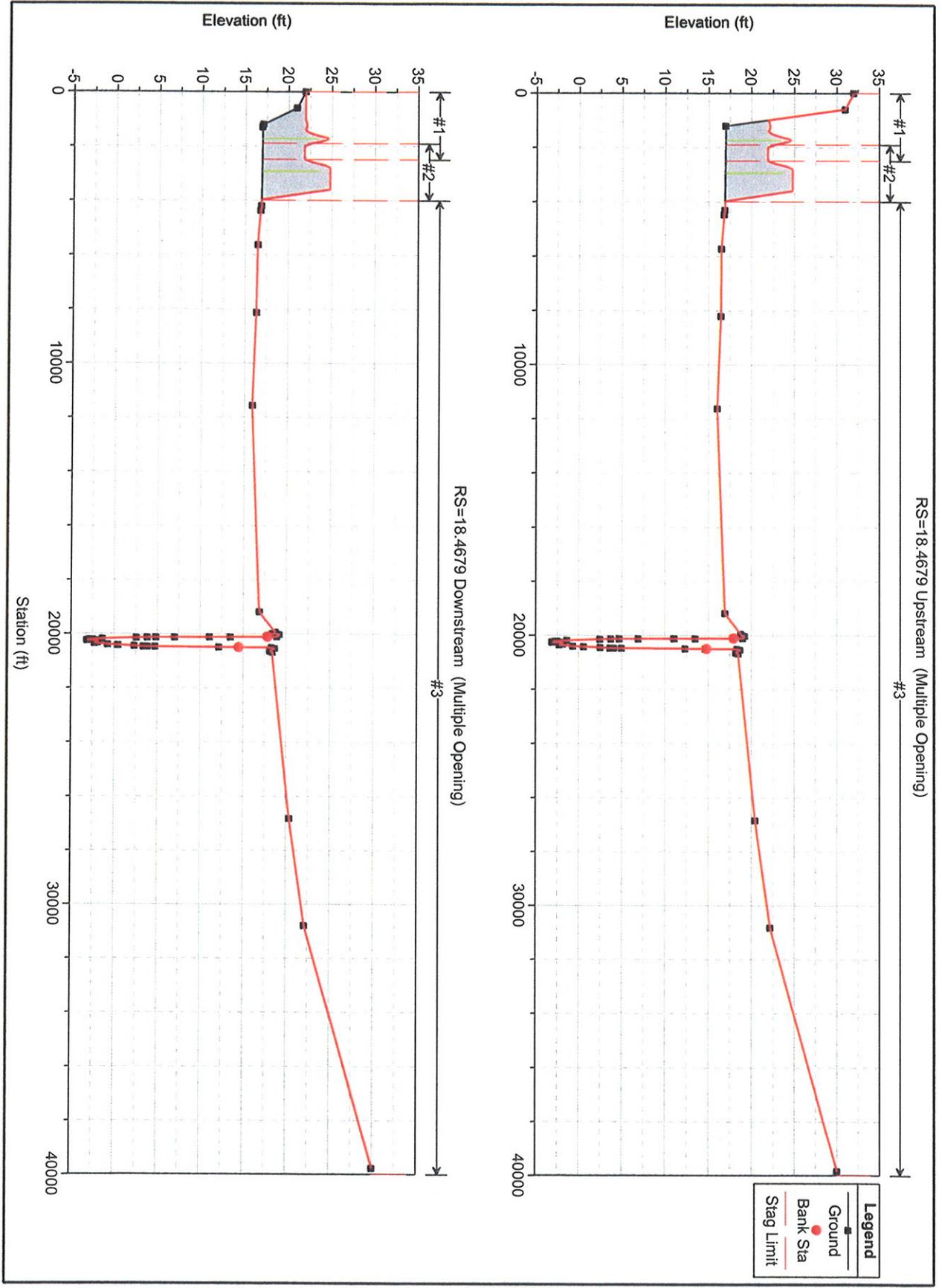
APALACHICOLA RIVER 4-16x8 box culverts Plan: 1) Separate Box 8/17/2007 2) FEMA DE 8/15/2007

River = APALACHICOLA RIV Reach = 1 RS = 18.4679 MO Existing bridges

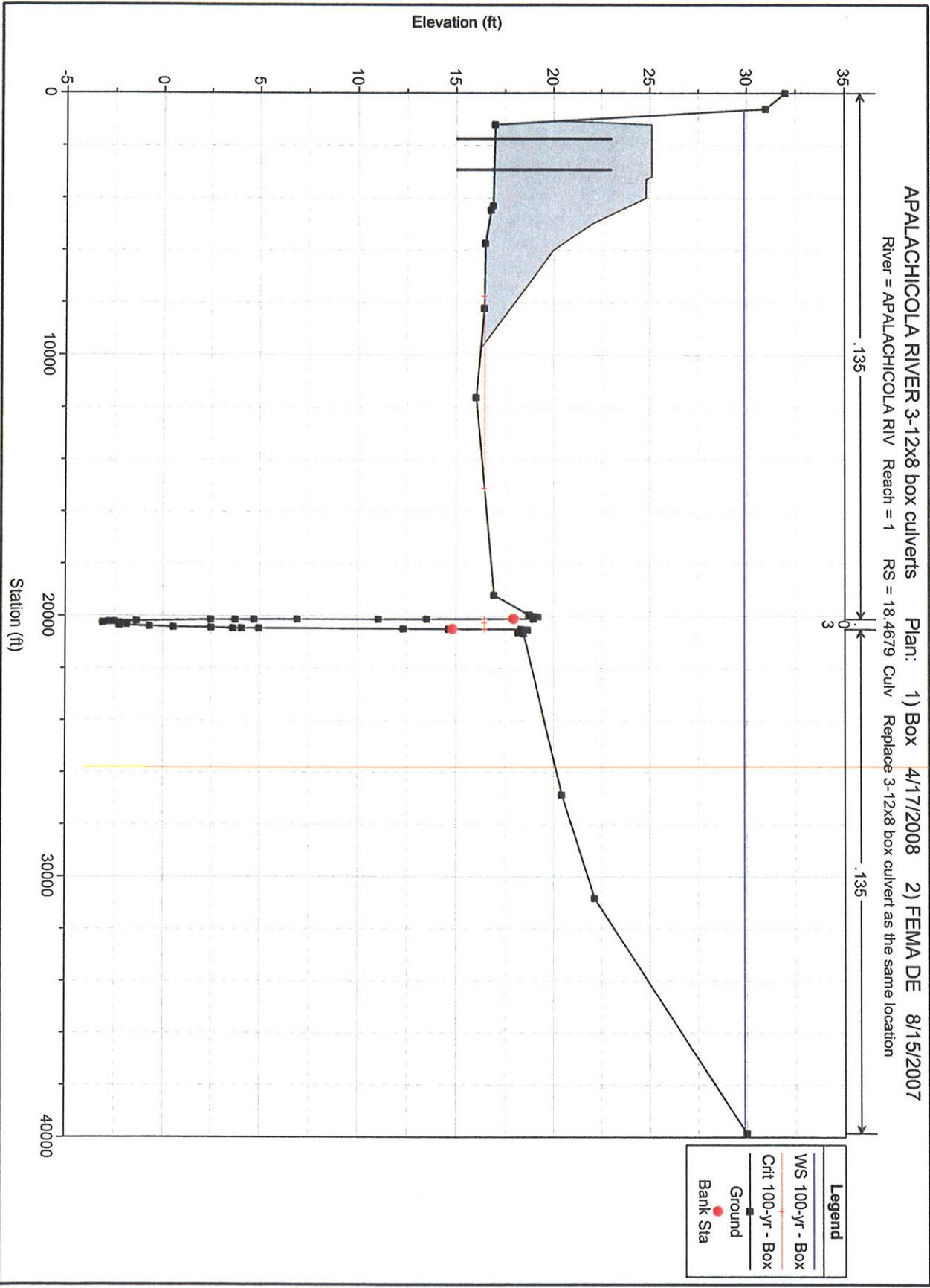


← .135 →
0
← .135 →

Legend	
WS 100-yr - Separate Box	—
Crit 100-yr - Separate Box	- - -
Ground	—●—
Bank Sta	—○—

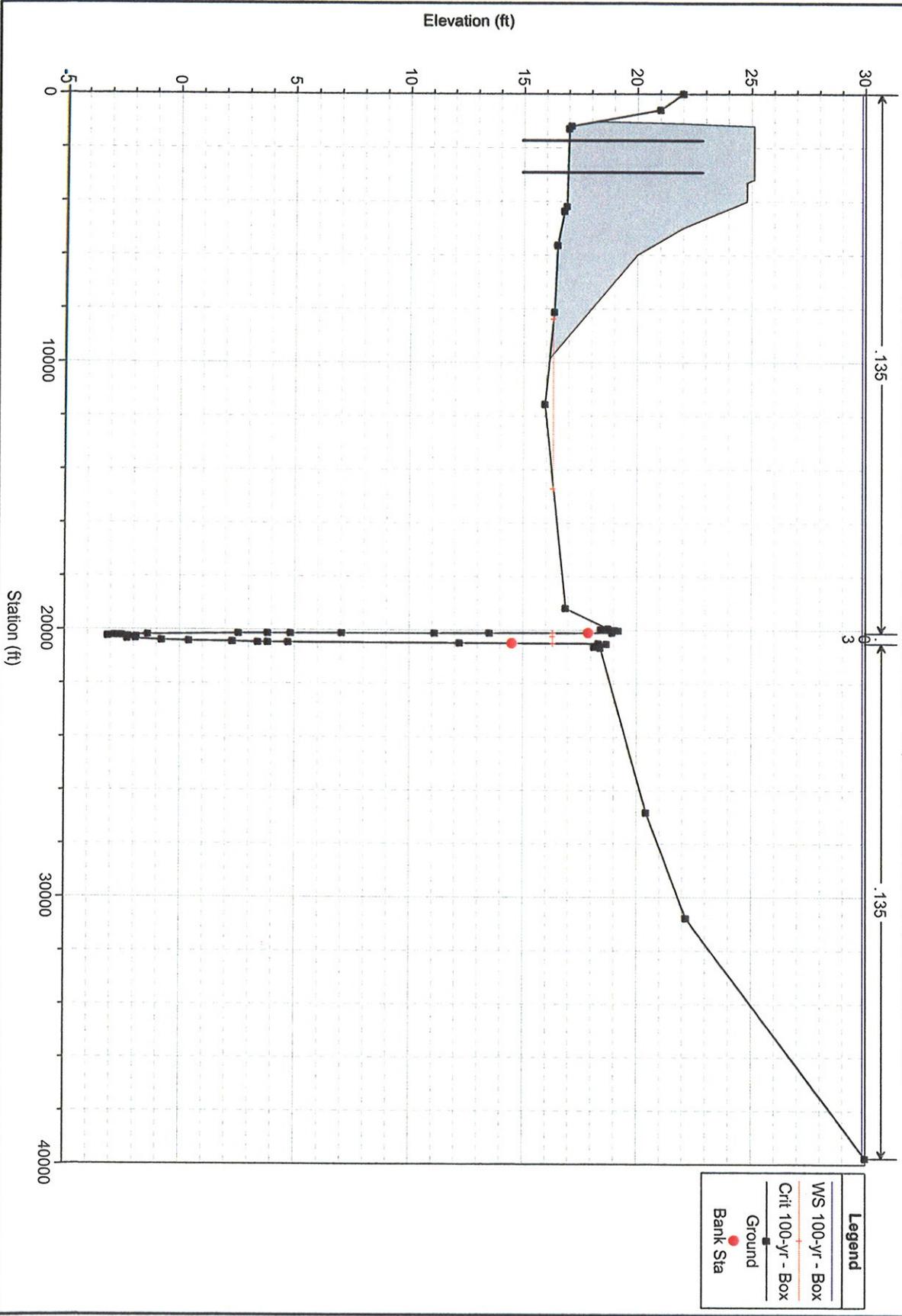


APALACHICOLA RIVER 3-12x8 box culverts Plan: 1) Box 4/17/2008 2) FEMA DE 8/15/2007
 River = APALACHICOLA RIV Reach = 1 RS = 18.4679 Culv Replace 3-12x8 box culvert as the same location



Legend	
WS 100-yr - Box	—
Crit 100-yr - Box	—
Ground	■
Bank Sta	●

APALACHICOLA RIVER 3-12x8 box culverts Plan: 1) Box 4/17/2008 2) FEMA DE 8/15/2007
 River = APALACHICOLA RIV Reach = 1 RS = 18.4679 Culv Replace 3-12x8 box culvert as the same location



HEC-RAS River: APALACHICOLA RIV Reach: 1

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch Elevation (ft)	W.S. Elevation (ft)	Cut W.S. (ft)	E.G. Elevation (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	20	2-yr	Box	105000.00	-6.30	26.98		27.07	0.000132	4.19	168960.30	26236.31	0.16
1	20	2-yr	FEMA DE	105000.00	-6.30	26.07		26.21	0.000192	4.91	145274.30	25954.94	0.20
1	20	10-yr	Box	169000.00	-6.30	29.79		29.87	0.000129	4.51	243977.70	27108.21	0.16
1	20	10-yr	FEMA DE	169000.00	-6.30	28.34		28.48	0.000206	5.47	205038.20	26659.19	0.21
1	20	50-yr	Box	230000.00	-6.30	31.99		32.07	0.000128	4.78	304330.00	27691.41	0.17
1	20	50-yr	FEMA DE	230000.00	-6.30	30.28		30.42	0.000205	5.78	257486.90	27248.06	0.21
1	20	100-yr	Box	257000.00	-6.30	32.85		32.94	0.000128	4.90	328361.30	27916.13	0.17
1	20	100-yr	FEMA DE	257000.00	-6.30	31.07		31.20	0.000205	5.90	278899.80	27451.60	0.21
1	20	500-yr	Box	322000.00	-6.30	34.74		34.82	0.000131	5.17	381400.90	28405.83	0.17
1	20	500-yr	FEMA DE	322000.00	-6.30	32.77		32.91	0.000206	6.18	326091.60	27894.99	0.21
1	19.5*	2-yr	Box	105000.00	-3.80	25.78		25.98	0.000200	5.43	142665.30	28828.85	0.20
1	19.5*	10-yr	Box	169000.00	-3.80	28.70		28.84	0.000165	5.36	228734.50	30061.77	0.19
1	19.5*	50-yr	Box	230000.00	-3.80	30.95		31.06	0.000152	5.44	297146.80	30928.16	0.18
1	19.5*	100-yr	Box	257000.00	-3.80	31.82		31.93	0.000149	5.51	324187.80	31284.11	0.18
1	19.5*	500-yr	Box	322000.00	-3.80	33.71		33.81	0.000144	5.65	383773.30	31528.50	0.18
1	19	2-yr	Box	105000.00	-1.30	24.84		25.22	0.000292	6.77	113040.90	27131.98	0.25
1	19	2-yr	FEMA DE	105000.00	-1.30	22.31		23.89	0.000965	11.38	48923.95	23471.63	0.44
1	19	10-yr	Box	169000.00	-1.30	27.94		28.17	0.000223	6.43	204175.90	31613.65	0.22
1	19	10-yr	FEMA DE	169000.00	-1.30	25.79		26.39	0.000505	9.14	139549.10	28508.30	0.33
1	19	50-yr	Box	230000.00	-1.30	30.27		30.44	0.000193	6.33	281382.60	34583.00	0.21
1	19	50-yr	FEMA DE	230000.00	-1.30	28.05		28.46	0.000398	8.61	207626.80	31770.93	0.30
1	19	100-yr	Box	257000.00	-1.30	31.17		31.32	0.000181	6.25	312562.30	34583.00	0.20
1	19	100-yr	FEMA DE	257000.00	-1.30	28.92		29.28	0.000371	8.50	235602.10	33018.32	0.29
1	19	500-yr	Box	322000.00	-1.30	33.10		33.24	0.000163	6.19	379594.70	34583.00	0.19
1	19	500-yr	FEMA DE	322000.00	-1.30	30.77		31.06	0.000321	8.25	298975.80	34583.00	0.27
1	18.4777	2-yr	Box	105000.00	-3.07	23.30		23.42	0.000134	4.53	169303.90	31224.92	0.17
1	18.4777	10-yr	Box	169000.00	-3.07	26.57		26.65	0.000106	4.42	277800.40	35116.63	0.15
1	18.4777	50-yr	Box	230000.00	-3.07	28.95		29.02	0.000098	4.51	364927.60	37954.02	0.15
1	18.4777	100-yr	Box	257000.00	-3.07	29.88		29.95	0.000096	4.56	400605.20	39056.46	0.15
1	18.4777	500-yr	Box	322000.00	-3.07	31.85		31.91	0.000093	4.69	478126.60	39752.66	0.15
1	18.4677		Culvert										
1	18.4677	2-yr	Box	105000.00	-3.11	23.29		23.41	0.000130	4.48	173158.60	32074.07	0.17
1	18.4677	10-yr	Box	169000.00	-3.11	26.56		26.64	0.000102	4.34	284214.30	35625.62	0.15
1	18.4677	50-yr	Box	230000.00	-3.11	28.85		29.01	0.000094	4.42	372851.30	38559.14	0.15
1	18.4677	100-yr	Box	257000.00	-3.11	29.87		29.94	0.000092	4.47	409045.30	39621.09	0.15
1	18.4677	500-yr	Box	322000.00	-3.11	31.84		31.90	0.000088	4.55	487397.50	39768.16	0.14

HEC-FRAS River: APALACHICOLA RIV Reach: 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Chl W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	18	2-yr	Box	105000.00	-4.50	22.94		23.01	0.000069	3.47	204123.50	28067.10	0.12
1	18	2-yr	FEMA DE	105000.00	-4.50	20.98		21.12	0.000136	4.62	151273.80	25772.06	0.17
1	18	10-yr	Box	169000.00	-4.50	26.20		26.26	0.000069	3.77	301935.40	31881.75	0.12
1	18	10-yr	FEMA DE	169000.00	-4.50	24.02		24.13	0.000128	4.86	234984.40	29324.30	0.17
1	18	50-yr	Box	230000.00	-4.50	28.58		28.63	0.000072	4.05	380843.70	34654.49	0.13
1	18	50-yr	FEMA DE	230000.00	-4.50	26.21		26.32	0.000128	5.13	302059.60	31886.30	0.17
1	18	100-yr	Box	257000.00	-4.50	29.50		29.56	0.000073	4.16	413259.30	35731.23	0.13
1	18	100-yr	FEMA DE	257000.00	-4.50	27.06		27.17	0.000129	5.25	325543.90	32878.49	0.17
1	18	500-yr	Box	322000.00	-4.50	31.46		31.52	0.000074	4.37	484404.30	36320.00	0.13
1	18	500-yr	FEMA DE	322000.00	-4.50	28.90		29.01	0.000130	5.50	392200.30	35035.49	0.17
1	17.75*	2-yr	Box	105000.00	-5.65	22.26		22.32	0.000078	3.57	202472.00	29448.49	0.13
1	17.75*	10-yr	Box	169000.00	-5.65	25.53		25.59	0.000074	3.79	306575.20	34143.67	0.13
1	17.75*	50-yr	Box	230000.00	-5.65	27.89		27.94	0.000074	4.01	390818.80	36827.30	0.13
1	17.75*	100-yr	Box	257000.00	-5.65	28.80		28.86	0.000074	4.08	424635.40	36930.41	0.13
1	17.75*	500-yr	Box	322000.00	-5.65	30.75		30.81	0.000074	4.26	496813.90	37065.00	0.13
1	17.5*	2-yr	Box	105000.00	-6.80	22.09		22.14	0.000070	3.33	222798.10	32447.70	0.12
1	17.5*	10-yr	Box	169000.00	-6.80	25.37		25.42	0.000065	3.50	338647.90	37462.31	0.12
1	17.5*	50-yr	Box	230000.00	-6.80	27.73		27.77	0.000063	3.65	427201.00	37639.49	0.12
1	17.5*	100-yr	Box	257000.00	-6.80	28.65		28.69	0.000062	3.72	461734.70	37708.37	0.12
1	17.5*	500-yr	Box	322000.00	-6.80	30.59		30.64	0.000063	3.91	535245.50	37810.00	0.12
1	17.25*	2-yr	Box	105000.00	-7.95	21.95		21.99	0.000057	3.02	255051.10	36947.70	0.11
1	17.25*	10-yr	Box	169000.00	-7.95	25.24		25.27	0.000050	3.09	380440.60	38250.48	0.11
1	17.25*	50-yr	Box	230000.00	-7.95	27.60		27.63	0.000050	3.26	470806.90	38401.40	0.11
1	17.25*	100-yr	Box	257000.00	-7.95	28.52		28.55	0.000050	3.34	505989.90	38460.01	0.11
1	17.25*	500-yr	Box	322000.00	-7.95	30.46		30.49	0.000052	3.54	580764.60	38555.00	0.11
1	17	2-yr	Box	105000.00	-9.10	21.84		21.87	0.000040	2.55	301109.00	38781.62	0.09
1	17	2-yr	FEMA DE	105000.00	-9.10	20.06		20.12	0.000079	3.43	232420.00	38440.82	0.13
1	17	10-yr	Box	169000.00	-9.10	25.14		25.16	0.000037	2.69	429489.90	39003.66	0.09
1	17	10-yr	FEMA DE	169000.00	-9.10	23.21		23.25	0.000065	3.39	354276.10	38885.85	0.12
1	17	50-yr	Box	230000.00	-9.10	27.50		27.52	0.000038	2.89	521485.80	39147.27	0.09
1	17	50-yr	FEMA DE	230000.00	-9.10	25.40		25.44	0.000064	3.56	439585.60	39019.45	0.12
1	17	100-yr	Box	257000.00	-9.10	28.41		28.43	0.000039	2.98	557271.10	39203.00	0.10
1	17	100-yr	FEMA DE	257000.00	-9.10	26.24		26.28	0.000064	3.64	472423.50	39070.75	0.12
1	17	500-yr	Box	322000.00	-9.10	30.34		30.37	0.000041	3.19	633247.50	39300.00	0.10
1	17	500-yr	FEMA DE	322000.00	-9.10	28.06		28.10	0.000066	3.84	543732.40	39181.92	0.12
1	16.75*	2-yr	Box	105000.00	-8.95	21.24		21.27	0.000049	2.83	273671.80	36516.77	0.10
1	16.75*	10-yr	Box	169000.00	-8.95	24.58		24.61	0.000045	2.95	400924.80	38340.61	0.10

HEC-RAS River APALACHICOLA RIV Reach: 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	16.75*	50-yr	Box	230000.00	-8.95	26.92		26.94	0.000045	3.14	480832.90	38519.18	0.10
1	16.75*	100-yr	Box	257000.00	-8.95	27.82		27.85	0.000046	3.22	525647.50	38588.11	0.10
1	16.75*	500-yr	Box	322000.00	-8.95	29.72		29.75	0.000048	3.44	599166.00	38714.71	0.11
1	16.5*	2-yr	Box	105000.00	-8.80	21.06		21.10	0.000052	2.93	265918.00	35183.63	0.11
1	16.5*	10-yr	Box	169000.00	-8.80	24.41		24.44	0.000049	3.10	388013.30	37657.07	0.10
1	16.5*	50-yr	Box	230000.00	-8.80	26.75		26.78	0.000049	3.28	476336.70	37899.29	0.11
1	16.5*	100-yr	Box	257000.00	-8.80	27.65		27.68	0.000050	3.37	510515.80	37992.60	0.11
1	16.5*	500-yr	Box	322000.00	-8.80	29.54		29.58	0.000052	3.59	582604.70	38128.91	0.11
1	16.25*	2-yr	Box	105000.00	-8.65	20.88		20.92	0.000055	3.05	258157.00	34274.13	0.11
1	16.25*	10-yr	Box	169000.00	-8.65	24.24		24.27	0.000051	3.20	375259.60	36025.90	0.11
1	16.25*	50-yr	Box	230000.00	-8.65	26.57		26.60	0.000053	3.43	461353.20	37233.59	0.11
1	16.25*	100-yr	Box	257000.00	-8.65	27.47		27.50	0.000054	3.52	494871.00	37385.77	0.11
1	16.25*	500-yr	Box	322000.00	-8.65	29.35		29.39	0.000056	3.74	565501.30	37534.32	0.12
1	16	2-yr	Box	105000.00	-8.50	20.70		20.73	0.000051	2.97	255670.60	30936.15	0.10
1	16	10-yr	FEMA DE	105000.00	-8.50	19.01		19.06	0.000077	3.48	208436.00	26076.96	0.13
1	16	50-yr	Box	169000.00	-8.50	24.06		24.09	0.000052	3.27	364764.40	34007.81	0.11
1	16	100-yr	FEMA DE	169000.00	-8.50	22.17		22.23	0.000086	4.00	302368.10	32286.76	0.14
1	16	50-yr	Box	230000.00	-8.50	26.38		26.41	0.000056	3.57	446156.10	36129.79	0.11
1	16	100-yr	FEMA DE	230000.00	-8.50	24.34		24.40	0.000090	4.32	374385.20	34265.48	0.14
1	16	500-yr	Box	257000.00	-8.50	27.27		27.31	0.000057	3.66	478796.20	36727.05	0.12
1	16	100-yr	FEMA DE	257000.00	-8.50	25.16		25.22	0.000092	4.46	402878.20	35017.50	0.14
1	16	500-yr	Box	322000.00	-8.50	29.15		29.18	0.000060	3.91	547861.30	36914.62	0.12
1	16	500-yr	FEMA DE	322000.00	-8.50	26.94		27.00	0.000097	4.75	466530.20	36641.74	0.15
1	15.8333*	2-yr	Box	105000.00	-8.93	19.86		19.90	0.000058	3.15	232173.20	27139.87	0.11
1	15.8333*	10-yr	Box	169000.00	-8.93	23.16		23.20	0.000063	3.57	336592.80	32846.52	0.12
1	15.8333*	50-yr	Box	230000.00	-8.93	25.41		25.45	0.000068	3.89	412670.60	34812.38	0.13
1	15.8333*	100-yr	Box	257000.00	-8.93	26.27		26.32	0.000070	4.02	443169.80	35543.50	0.13
1	15.8333*	500-yr	Box	322000.00	-8.93	28.10		28.15	0.000073	4.27	508828.10	35987.73	0.13
1	15.6666*	2-yr	Box	105000.00	-9.37	19.71		19.75	0.000059	3.17	231264.90	27000.23	0.11
1	15.6666*	10-yr	Box	169000.00	-9.37	22.99		23.04	0.000064	3.61	333139.00	32336.72	0.12
1	15.6666*	50-yr	Box	230000.00	-9.37	25.23		25.28	0.000069	3.94	407498.00	34174.04	0.13
1	15.6666*	100-yr	Box	257000.00	-9.37	26.09		26.14	0.000071	4.07	437226.80	34853.04	0.13
1	15.6666*	500-yr	Box	322000.00	-9.37	27.91		27.96	0.000074	4.33	501094.30	35138.88	0.13
1	15.5*	2-yr	Box	105000.00	-9.80	19.56		19.61	0.000059	3.16	230649.30	26619.70	0.11
1	15.5*	10-yr	Box	169000.00	-9.80	22.83		22.87	0.000065	3.63	329628.50	31837.47	0.12
1	15.5*	50-yr	Box	230000.00	-9.80	25.05		25.10	0.000070	3.97	402173.90	33497.59	0.13

HEC-RAS River: APALACHICOLA RIV Reach: 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	15.5*	100-yr	Box	257000.00	-9.80	26.90		25.95	0.000073	4.11	431095.20	34129.45	0.13
1	15.5*	500-yr	Box	322000.00	-9.80	27.72		27.77	0.000076	4.37	493136.20	34285.75	0.14
1	15.3333*	2-yr	Box	105000.00	-10.23	19.42		19.46	0.000059	3.13	230102.00	26127.95	0.11
1	15.3333*	10-yr	Box	169000.00	-10.23	22.66		22.71	0.000067	3.63	326091.40	31254.97	0.12
1	15.3333*	50-yr	Box	230000.00	-10.23	24.87		24.92	0.000072	3.98	396697.30	32793.18	0.13
1	15.3333*	100-yr	Box	257000.00	-10.23	25.72		25.77	0.000075	4.13	424789.50	33354.81	0.13
1	15.3333*	500-yr	Box	322000.00	-10.23	27.52		27.57	0.000078	4.39	484976.50	33429.93	0.14
1	15.1666*	2-yr	Box	105000.00	-10.67	19.27		19.31	0.000059	3.09	229491.70	25575.83	0.11
1	15.1666*	10-yr	Box	169000.00	-10.67	22.49		22.54	0.000068	3.63	322459.10	30625.70	0.12
1	15.1666*	50-yr	Box	230000.00	-10.67	24.68		24.73	0.000074	3.99	391063.50	32073.95	0.13
1	15.1666*	100-yr	Box	257000.00	-10.67	26.53		26.57	0.000077	4.13	418314.90	32509.11	0.13
1	15.1666*	500-yr	Box	322000.00	-10.67	27.32		27.37	0.000081	4.41	476628.10	32572.21	0.14
1	15	2-yr	Box	105000.00	-11.10	19.13		19.16	0.000060	3.04	228723.10	24994.14	0.11
1	15	10-yr	Box	169000.00	-11.10	17.75		17.80	0.000092	3.61	194847.70	24195.29	0.14
1	15	50-yr	Box	230000.00	-11.10	22.32		22.36	0.000070	3.60	318647.30	29863.47	0.13
1	15	100-yr	Box	257000.00	-11.10	20.71		20.77	0.000109	4.30	271094.10	28846.38	0.15
1	15	500-yr	Box	320000.00	-11.10	24.49		24.54	0.000077	3.97	385173.70	31331.03	0.13
1	15	2-yr	FEMA DE	230000.00	-11.10	22.77		22.84	0.000116	4.68	332180.30	30246.68	0.16
1	15	100-yr	Box	257000.00	-11.10	26.33		26.38	0.000079	4.11	411568.30	31659.90	0.14
1	15	100-yr	FEMA DE	257000.00	-11.10	23.55		23.61	0.000120	4.85	355742.40	30733.53	0.16
1	15	500-yr	Box	322000.00	-11.10	27.11		27.16	0.000084	4.40	467989.20	31713.32	0.14
1	15	500-yr	FEMA DE	322000.00	-11.10	25.22		25.29	0.000128	5.21	407970.00	31656.50	0.17
1	14.5*	2-yr	Box	105000.00	-14.30	18.88		18.94	0.000066	3.55	214787.30	26594.95	0.12
1	14.5*	10-yr	Box	169000.00	-14.30	22.06		22.12	0.000072	3.98	306274.80	29929.86	0.13
1	14.5*	50-yr	Box	230000.00	-14.30	24.21		24.27	0.000079	4.37	371796.70	31025.26	0.14
1	14.5*	100-yr	Box	257000.00	-14.30	25.03		25.10	0.000082	4.53	397647.10	31431.16	0.14
1	14.5*	500-yr	Box	322000.00	-14.30	26.80		26.87	0.000087	4.83	453188.20	31491.18	0.15
1	14	2-yr	Box	105000.00	-17.50	18.74		18.82	0.000067	3.84	206570.30	27639.36	0.12
1	14	2-yr	FEMA DE	105000.00	-17.50	17.30		17.45	0.000105	4.65	168107.30	26099.52	0.15
1	14	10-yr	Box	169000.00	-17.50	21.91		21.99	0.000071	4.23	298636.30	29841.19	0.13
1	14	10-yr	FEMA DE	169000.00	-17.50	20.25		20.38	0.000112	5.13	249563.80	29108.63	0.16
1	14	50-yr	Box	230000.00	-17.50	24.05		24.13	0.000078	4.63	363468.50	30782.28	0.14
1	14	50-yr	FEMA DE	230000.00	-17.50	22.30		22.43	0.000119	5.52	310114.40	30009.95	0.17
1	14	100-yr	Box	257000.00	-17.50	24.87		24.96	0.000081	4.79	388937.50	31144.20	0.14
1	14	100-yr	FEMA DE	257000.00	-17.50	23.06		23.19	0.000123	5.70	333073.20	30344.70	0.17
1	14	500-yr	Box	322000.00	-17.50	26.63		26.72	0.000087	5.12	443786.40	31265.18	0.15
1	14	500-yr	FEMA DE	322000.00	-17.50	24.70		24.84	0.000133	6.10	383548.40	31067.97	0.18

HEC-RAS River APALACHICOLA RIV Reachr. 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	13.75*	2-yr	Box	105000.00	-17.90	17.87		17.99	0.000087	4.23	181845.30	27150.15	0.14
1	13.75*	10-yr	Box	169000.00	-17.90	21.00		21.11	0.000091	4.64	272768.50	30958.61	0.15
1	13.75*	50-yr	Box	230000.00	-17.90	23.05		23.16	0.000100	5.07	338594.30	33034.93	0.16
1	13.75*	100-yr	Box	257000.00	-17.90	23.84		23.95	0.000103	5.23	364808.50	33432.73	0.16
1	13.75*	500-yr	Box	322000.00	-17.90	25.53		25.64	0.000109	5.56	421954.80	34047.96	0.16
1	13.5*	2-yr	Box	105000.00	-18.30	17.63		17.75	0.000091	4.19	176714.00	26980.54	0.14
1	13.5*	10-yr	Box	169000.00	-18.30	20.75		20.86	0.000095	4.60	267272.60	31116.07	0.15
1	13.5*	50-yr	Box	230000.00	-18.30	22.77		22.88	0.000106	5.07	332786.60	33892.88	0.16
1	13.5*	100-yr	Box	257000.00	-18.30	23.54		23.66	0.000110	5.25	359527.00	34962.95	0.16
1	13.5*	500-yr	Box	322000.00	-18.30	25.21		25.33	0.000118	5.62	419637.10	36781.06	0.17
1	13.25*	2-yr	Box	105000.00	-18.70	17.41		17.50	0.000085	3.88	176060.80	22496.88	0.14
1	13.25*	10-yr	Box	169000.00	-18.70	20.50		20.60	0.000097	4.48	264388.20	30928.31	0.15
1	13.25*	50-yr	Box	230000.00	-18.70	22.48		22.59	0.000108	4.97	328652.30	33879.35	0.16
1	13.25*	100-yr	Box	257000.00	-18.70	23.25		23.36	0.000113	5.15	354977.90	35016.50	0.16
1	13.25*	500-yr	Box	322000.00	-18.70	24.89		25.00	0.000123	5.56	414439.50	37458.15	0.17
1	13	2-yr	Box	105000.00	-19.10	17.21		17.28	0.000078	3.57	189080.90	23735.79	0.13
1	13	10-yr	FEMA DE	105000.00	-19.10	16.18		16.28	0.000109	4.08	164915.60	23033.09	0.15
1	13	50-yr	Box	169000.00	-19.10	20.25		20.34	0.000096	4.28	265522.70	30999.18	0.15
1	13	100-yr	FEMA DE	169000.00	-19.10	19.00		19.10	0.000122	4.67	232600.90	24951.46	0.16
1	13	500-yr	Box	230000.00	-19.10	22.20		22.29	0.000109	4.78	327769.90	33515.69	0.16
1	13	2-yr	FEMA DE	230000.00	-19.10	20.83		20.96	0.000153	5.48	283324.00	31322.10	0.18
1	13	100-yr	Box	257000.00	-19.10	22.95		23.05	0.000114	4.97	353376.50	34716.60	0.16
1	13	500-yr	FEMA DE	257000.00	-19.10	21.52		21.66	0.000161	5.71	305474.20	32433.86	0.19
1	13	100-yr	Box	322000.00	-19.10	24.56		24.67	0.000125	5.39	411407.50	37295.33	0.17
1	13	500-yr	FEMA DE	322000.00	-19.10	23.02		23.18	0.000176	6.19	356037.00	34839.06	0.20
1	12.8*	2-yr	Box	105000.00	-18.00	15.97		16.07	0.000102	3.98	172530.40	25179.08	0.15
1	12.8*	10-yr	Box	169000.00	-18.00	18.81		18.92	0.000118	4.64	250673.00	32104.19	0.16
1	12.8*	50-yr	Box	230000.00	-18.00	20.56		20.68	0.000134	5.16	309190.80	34481.50	0.17
1	12.8*	100-yr	Box	257000.00	-18.00	21.24		21.36	0.000141	5.36	332777.00	35394.58	0.18
1	12.8*	500-yr	Box	322000.00	-18.00	22.69		22.82	0.000154	5.81	385383.90	37350.80	0.19
1	12.6*	2-yr	Box	105000.00	-16.90	15.70		15.80	0.000098	3.92	179012.60	27575.76	0.14
1	12.6*	10-yr	Box	169000.00	-16.90	18.52		18.61	0.000105	4.39	271329.90	34986.90	0.15
1	12.6*	50-yr	Box	230000.00	-16.90	20.24		20.34	0.000119	4.87	333413.20	37176.40	0.16
1	12.6*	100-yr	Box	257000.00	-16.90	20.90		21.01	0.000125	5.07	358221.20	38016.05	0.17
1	12.6*	500-yr	Box	322000.00	-16.90	22.32		22.43	0.000133	5.41	412793.30	38719.40	0.18

HEC-RAS River: APALACHICOLA RIV Reacr: 1 (Continued)

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	12.4*	2-yr	Box	105000.00	-15.80	15.43		15.54	0.000094	3.87	192082.30	34225.38	0.14
1	12.4*	10-yr	Box	169000.00	-15.80	18.26		18.35	0.000093	4.13	293893.50	37848.74	0.14
1	12.4*	50-yr	Box	230000.00	-15.80	19.95		20.04	0.000102	4.53	359371.30	39079.96	0.15
1	12.4*	100-yr	Box	257000.00	-15.80	20.60		20.70	0.000106	4.69	384829.90	39304.11	0.16
1	12.4*	500-yr	Box	322000.00	-15.80	22.00		22.10	0.000115	5.04	440172.60	39954.14	0.16
1	12.2*	2-yr	Box	105000.00	-14.70	15.20		15.29	0.000083	3.65	208155.80	37146.73	0.13
1	12.2*	10-yr	Box	169000.00	-14.70	18.04		18.11	0.000078	3.82	318494.00	39624.41	0.13
1	12.2*	50-yr	Box	230000.00	-14.70	19.71		19.79	0.000087	4.19	385431.60	40251.63	0.14
1	12.2*	100-yr	Box	257000.00	-14.70	20.35		20.43	0.000090	4.34	411241.00	40415.14	0.14
1	12.2*	500-yr	Box	322000.00	-14.70	21.73		21.81	0.000100	4.71	467227.60	41193.17	0.15
1	12	2-yr	Box	105000.00	-13.60	15.00	1.62	15.08	0.000072	3.41	226800.80	40456.00	0.12
1	12	2-yr	FEMA DE	105000.00	-13.60	15.00	1.65	15.08	0.000072	3.41	226784.80	40456.00	0.12
1	12	10-yr	Box	169000.00	-13.60	17.86	9.01	17.92	0.000065	3.51	343282.00	40999.40	0.12
1	12	10-yr	FEMA DE	169000.00	-13.60	17.86	9.00	17.92	0.000065	3.51	343266.00	40999.40	0.12
1	12	50-yr	Box	230000.00	-13.60	19.51	12.00	19.57	0.000074	3.88	411189.70	41312.90	0.13
1	12	50-yr	FEMA DE	230000.00	-13.60	19.51	12.00	19.57	0.000074	3.88	411173.70	41312.90	0.13
1	12	100-yr	Box	257000.00	-13.60	20.14	12.27	20.21	0.000078	4.04	437258.80	41495.43	0.13
1	12	100-yr	FEMA DE	257000.00	-13.60	20.14	12.27	20.20	0.000078	4.04	437242.80	41495.43	0.13
1	12	500-yr	Box	322000.00	-13.60	21.49	13.10	21.56	0.000087	4.42	493959.80	42357.81	0.14
1	12	500-yr	FEMA DE	322000.00	-13.60	21.49	13.10	21.56	0.000087	4.41	493843.80	42357.81	0.14